## GENERAL DESCRIPTION

The MXC3439ALA is a 3-axis MEMS accelerometer with a large feature set optimized for consumer product motion sensing. Applications include smartphones, user interface control, gaming motion input, game controllers, remote controls, and portable media products.

The MXC3439ALA features algorithms to support Any Motion/No Motion, Shake, Tilt/Flip and Tap/Double/Triple-Tap detection, 6D orientation, and Freefall detection.

Low power and low noise modes support a wide range of customer applications. A 32-sample FIFO supports data capture.

Two interrupt pins (INT1/INT2) can output any of 10 interrupt sources (sample, motion, FIFO) with selectable level and drive modes.

The MXC3439ALA is optimized for applications like smartphones, IOT, game controllers, and toys.

## FEATURES

### *Range, Sampling & Power*

- ±2, ±4, ±8, ±16g range
- 16-bit single sample resolution
- 16-bit resolution with 32-byte FIFO
- 1 to 1600 Hz Output Data Rate
- Typical active current
  - ✓ 1uA sleep mode
  - ✓ 10uA low power mode
  - ✓ 170uA low noise mode
- Full motion detection features

### *Simple System Integration*

- SPI up to 10 MHz
- I2C interface, up to 1 MHz
- I3C interface, up to 12.5 MHz
- 2×2×0.93 mm 12-pin LGA package
- RoHS compliant

### *Applications*

- Smartphones
- IOT Devices
- Game Controllers

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# 1. ORDER INFORMATION

| Part Number | Resolution | Order Number | Package | Tape & Reel |
|---|---|---|---|---|
| MXC3439ALA | 16bit | MXC3439ALA | LGA-12L | 10Ku |

**Table 1: Order Information**




| Row | Marking |
|---|---|
| B | Device Code |
| XX | Trace Code |
| CC | Factory Lot Code |
| ● | Pin1 Identifier |

**Table 2: Package Information**

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# 2. FUNCTIONAL BLOCK DIAGRAM

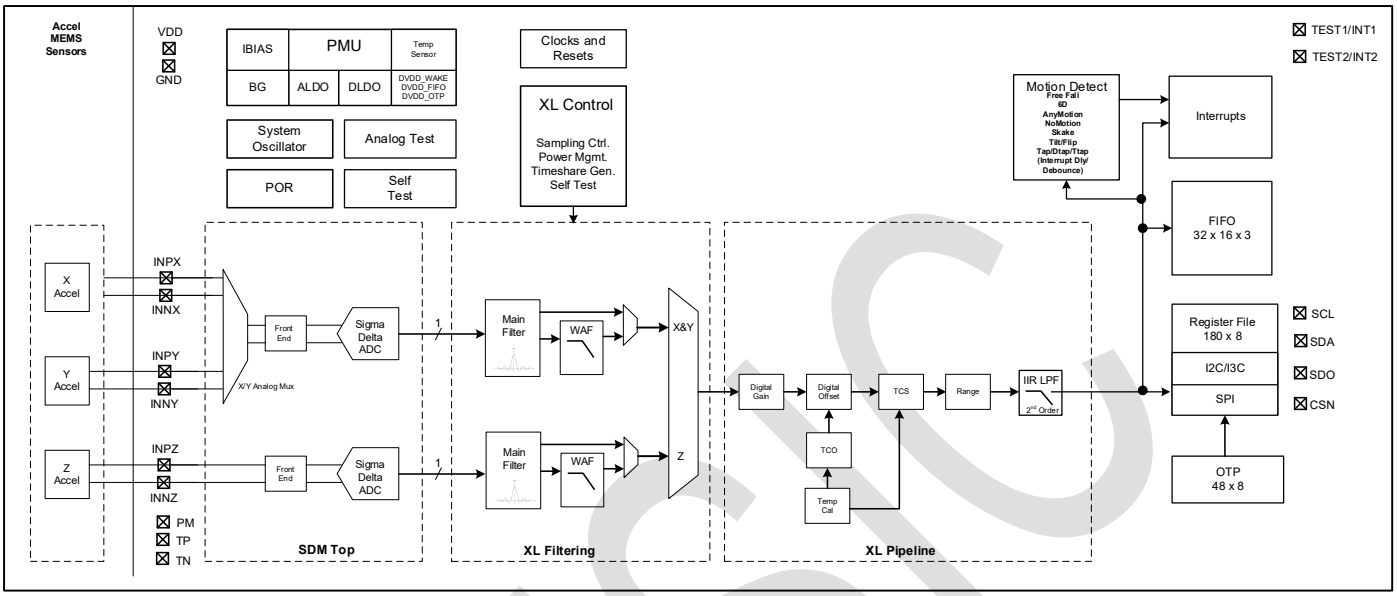



**Figure 1: Block Diagram**

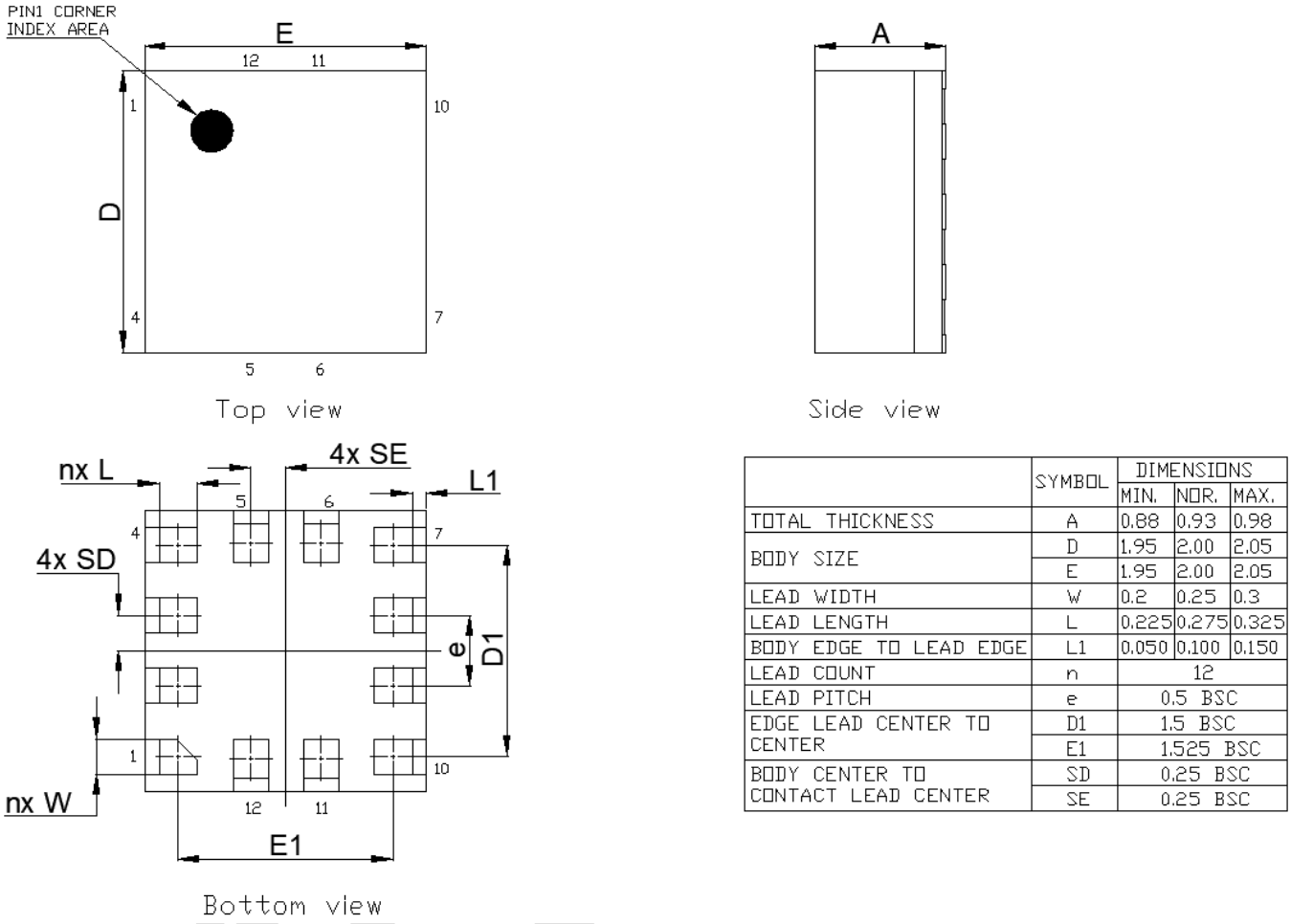
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# 3. PACKAGING AND PIN DESCRIPTION

## 3.1 PACKAGE OUTLINE




| | SYMBOL | DIMENSIONS | | |
|---|---|---|---|---|
| | | MIN. | NOR. | MAX. |
| TOTAL THICKNESS | A | 0.88 | 0.93 | 0.98 |
| BODY SIZE | D | 1.95 | 2.00 | 2.05 |
| | E | 1.95 | 2.00 | 2.05 |
| LEAD WIDTH | W | 0.2 | 0.25 | 0.3 |
| LEAD LENGTH | L | 0.225 | 0.275 | 0.325 |
| BODY EDGE TO LEAD EDGE | L1 | 0.050 | 0.100 | 0.150 |
| LEAD COUNT | n | 12 | | |
| LEAD PITCH | e | 0.5 BSC | | |
| EDGE LEAD CENTER TO CENTER | D1 | 1.5 BSC | | |
| | E1 | 1.525 BSC | | |
| BODY CENTER TO CONTACT LEAD CENTER | SD | 0.25 BSC | | |
| | SE | 0.25 BSC | | |

**Figure 2: Package Outline and Mechanical Dimensions**



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## 3.2 PACKAGE ORIENTATION

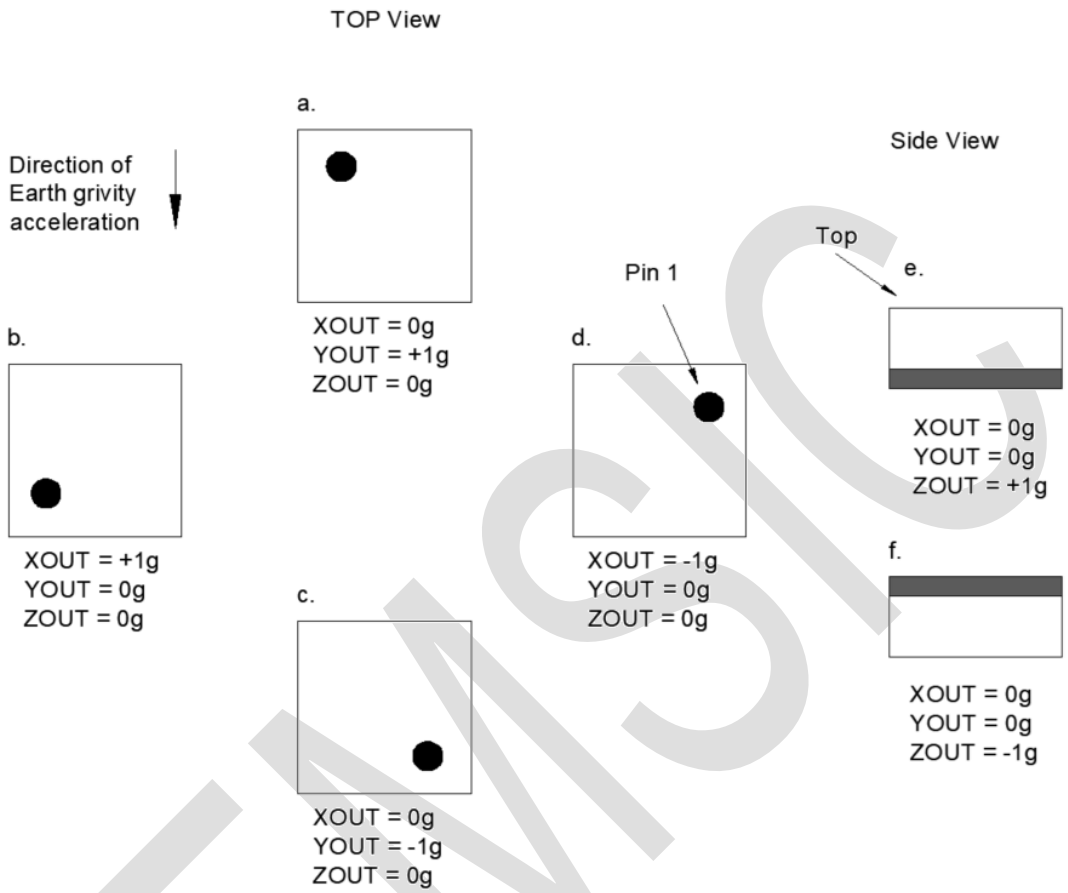



**Figure 3: Package Orientation**

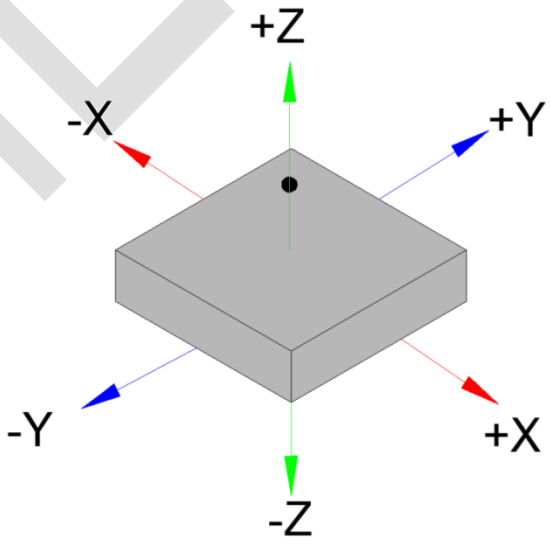


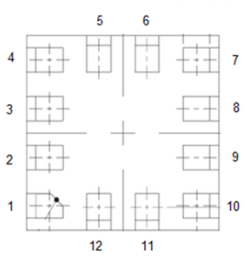

**Figure 4: Package Axis Reference**

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## 3.3 PIN DESCRIPTION




**(Bottom View)**

| Pin | Name | Function |
|---|---|---|
| 1 | SDO/DOUT_A6 | SPI data output (MISO)<br>Address select in I2C mode |
| 2 | SDI/SDA[1] | SPI data In (MOSI)<br>I2C serial data input/output |
| 3 | VDDIO | Power supply for interface |
| 4 | NC[4] | NC[4] |
| 5 | INT1[2] | Interrupt active LOW [3] |
| 6 | INT2[2] | Interrupt active LOW [3] |
| 7 | VDD | Power supply for internal |
| 8 | NC[4] | NC[4] |
| 9 | GND | Ground |
| 10 | CSN | Chip select for SPI (active low)<br>**I2C must connect to VDD** |
| 11 | NC[4] | NC[4] |
| 12 | SCK/SCL[1] | SPI/I2C serial clock |

**Table 3: Pin Description**

Notes:

1) SCL and SDA require a pull-up resistor, typically 4.7kΩ to pin VDD. Refer to I2C Specification for Fast-Mode devices. Higher resistance values can be used (typically done to reduce current leakage) but such applications are outside the scope of this datasheet.

2) INT1/2 pins can be configured by software to operate either as an open-drain output or push-pull output (mode register). If set to open-drain, then it requires a pull-up resistor, typically 4.7kΩ to VDDIO or VDD.

3) INT1/2 pin polarity is programmable in the pad control register.

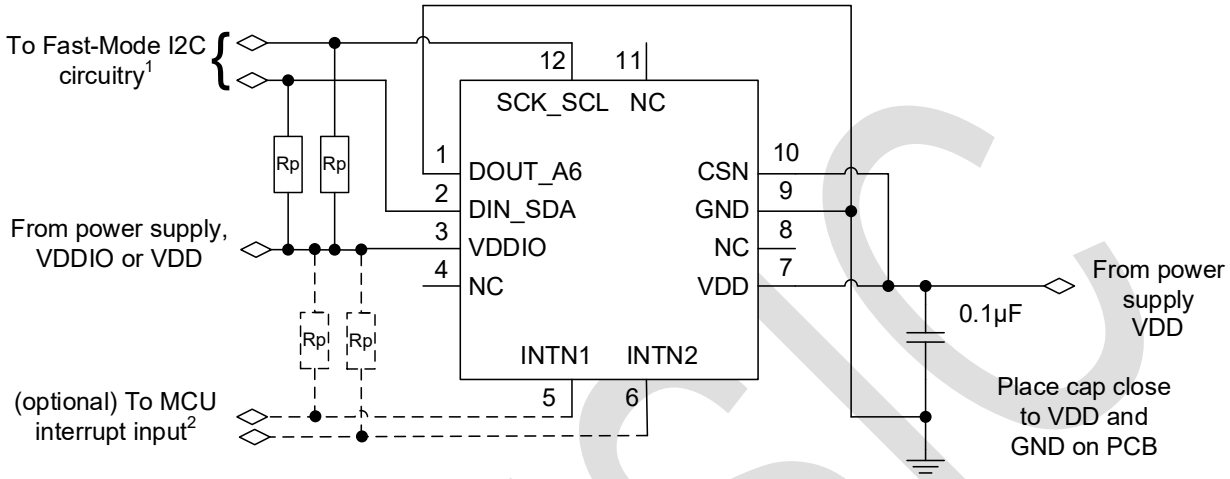
4) NC or “no connect” pins do not have any function on the MXC3439ALA, and may be left unconnected, tied to GND, or tied to VDD.



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## 3.4 TYPICAL APPLICATION CIRCUITS

### 3.4.1 I2C APPLICATION CIRCUIT




NOTE[1]: Rp are typically 4.7kΩ pullup resistors to VDDIO, per I2C specification. When VDDIO is powered down, DIN_SDA and SCK_SCL will be driven low by internal ESD diodes.

NOTE[2]: Attach typical 4.7kΩ pullup resistor if INTN is defined as open-drain.

**Figure 5: Typical I2C Application Circuit**

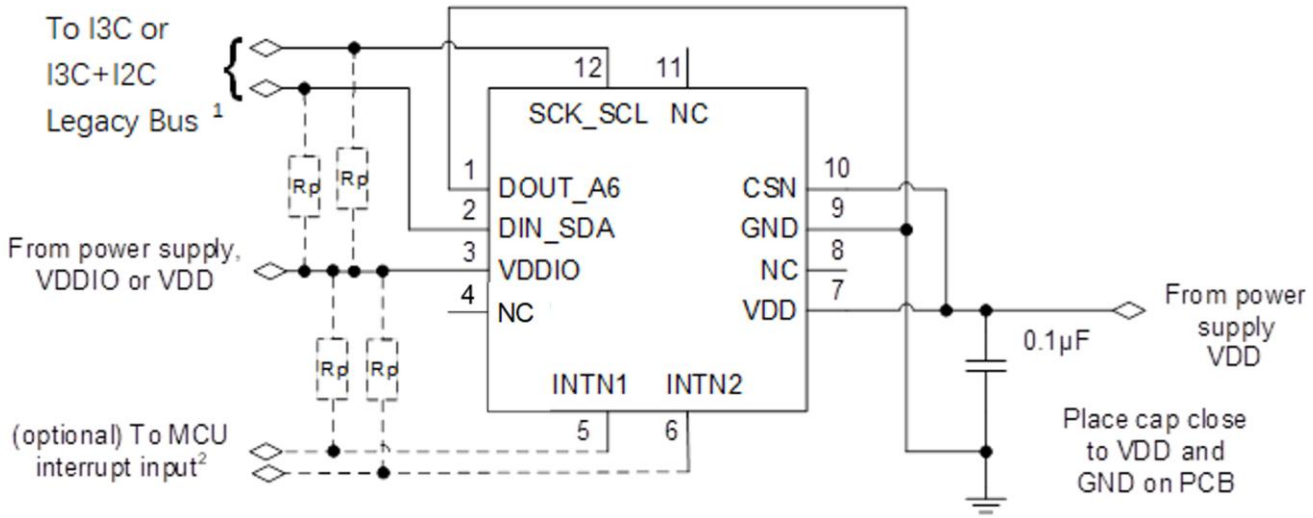
In typical applications, the interface power supply may contain significant noise from external sources and other circuits which should be kept away from the sensor. Therefore, for some applications a lower-noise power supply might be desirable to power the VDD pin.

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### 3.4.2 I3C APPLICATION CIRCUIT




NOTE[1]: For I2C+I3C open-drain operations, 1.1 k pullup resistors to VDDIO recommended.

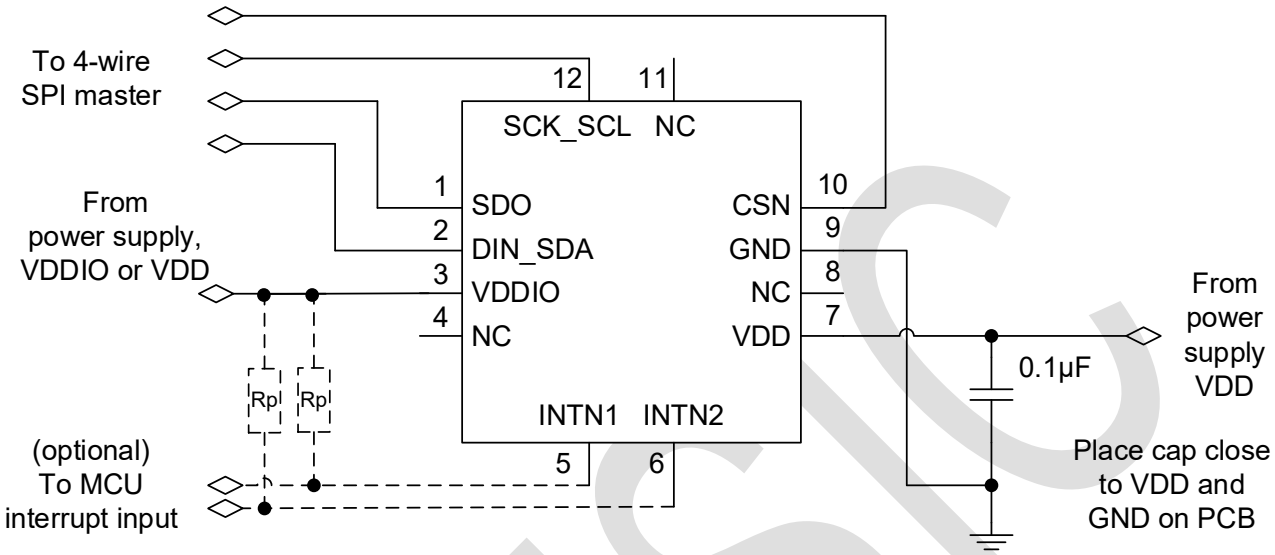
NOTE[2]: Attach typical 4.7kΩ pullup resistor if INTN is defined as open-drain.

**Figure 6: Typical I3C Application Circuit**



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### 3.4.3 SPI APPLICATION CIRCUIT (4-WIRE)




NOTE Rp: Attach typical 4.7kΩ pullup resistor if INTN is defined as open-drain.

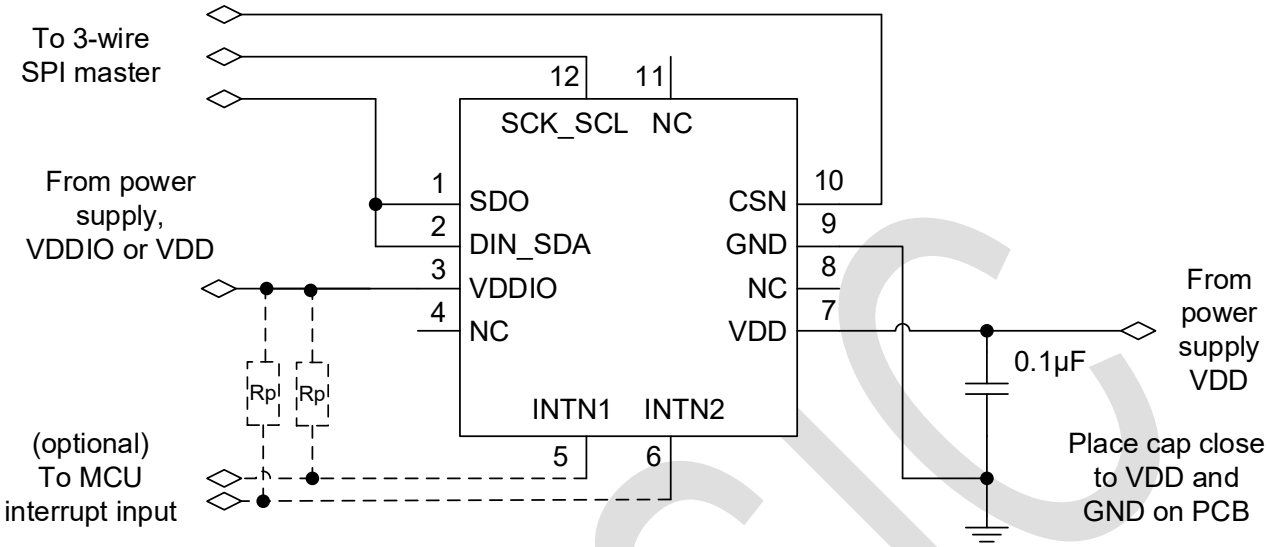
**Figure 7: Typical 4-wire SPI Application Circuit**

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### 3.4.4 SPI APPLICATION CIRCUIT (3-WIRE)




NOTE Rp: Attach typical 4.7kΩ pullup resistor if INTN is defined as open-drain.

**Figure 8: Typical 3-wire SPI Application Circuit**

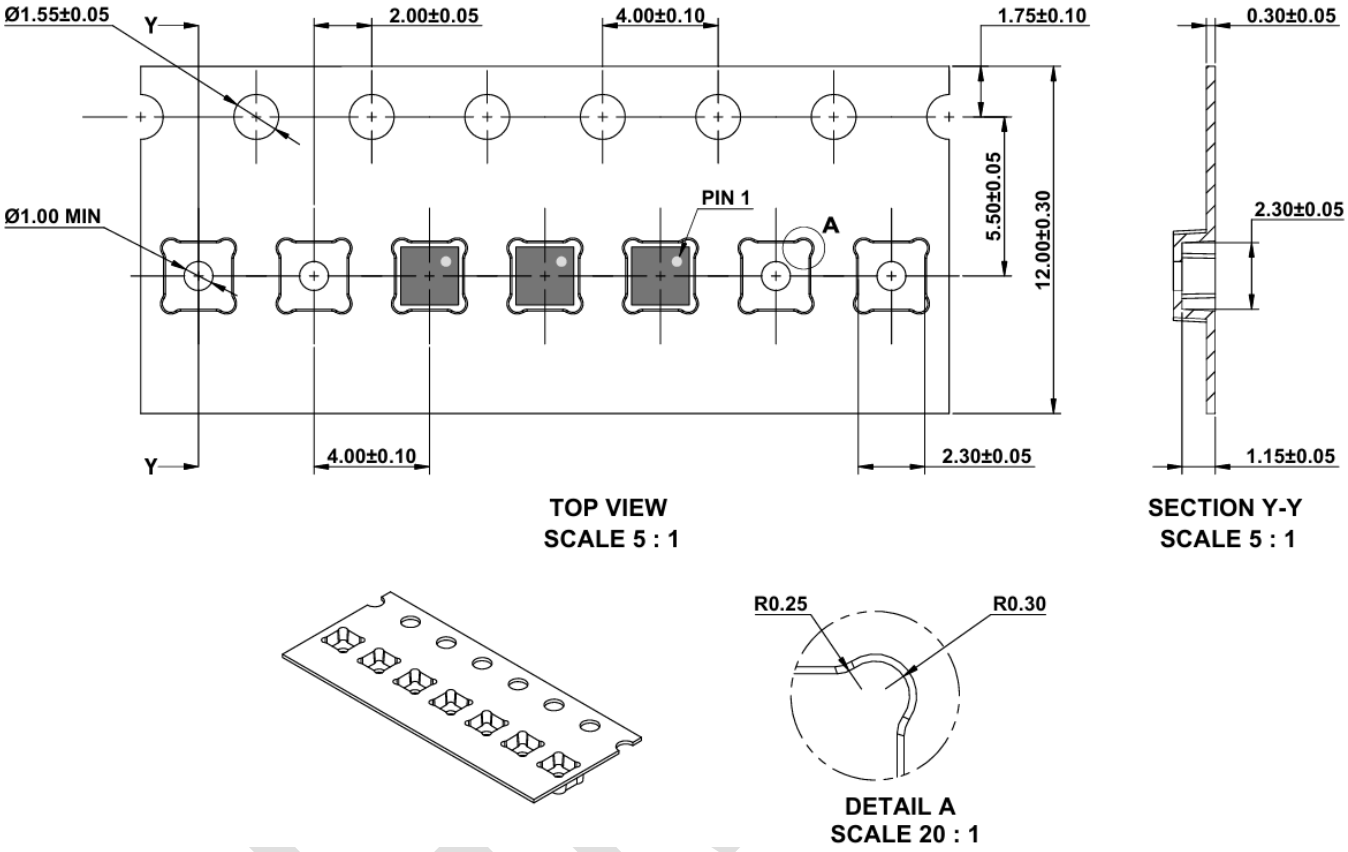
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## 3.5 TAPE AND REEL

Devices are shipped in reels, in standard cardboard box packaging. See **Figure 9: Tape Dimensions** and **Figure 10: Reel Dimensions**.

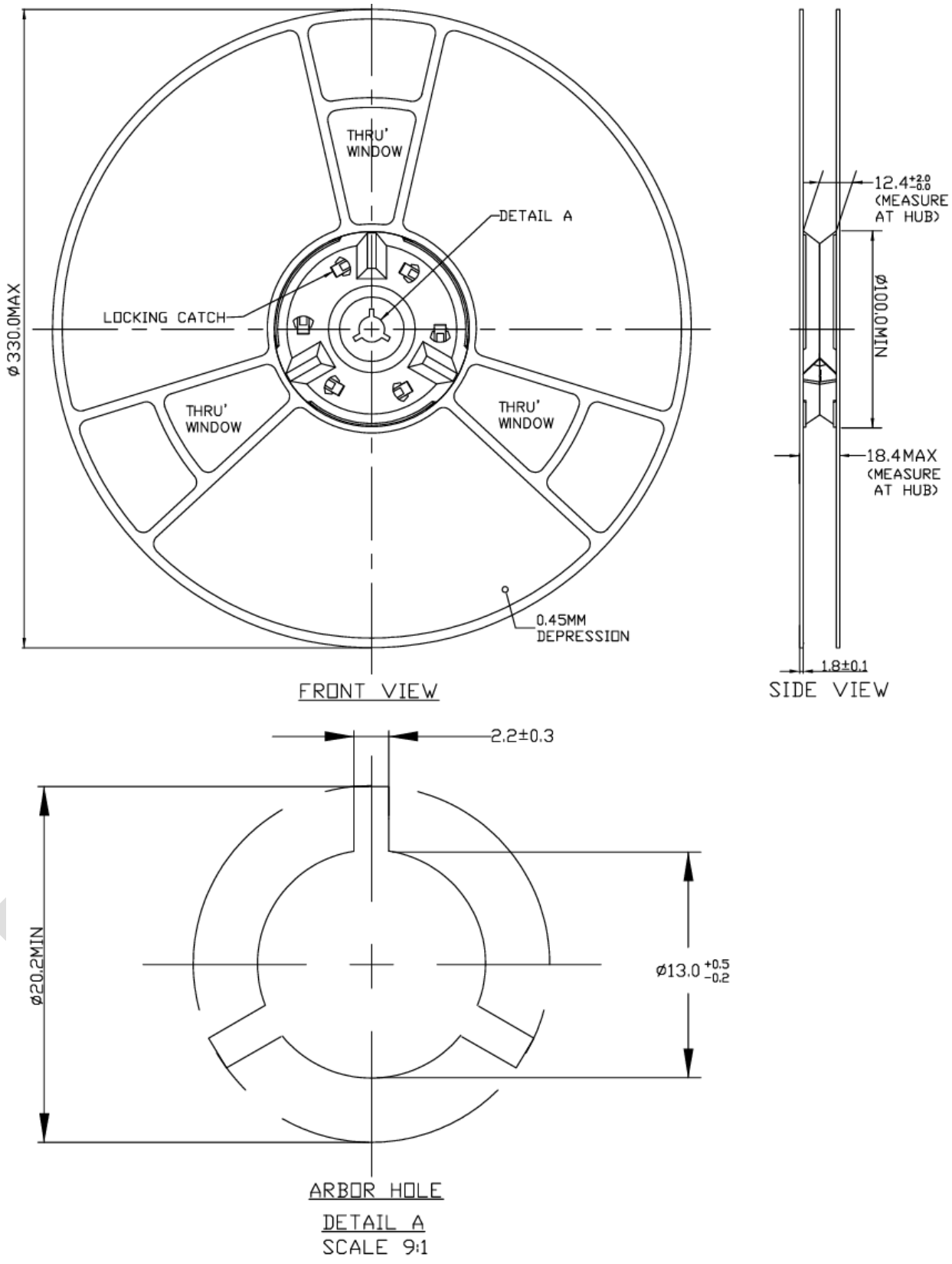



- Dimensions in mm.
- 10 sprocket hole pitch cumulative tolerance ±0.2
- Pocket position relative to sprocket hole measured as true position of pocket, not pocket hole.

**Figure 9: Tape Dimensions**



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- Dimensions in mm.

**Figure 10: Reel Dimensions**



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## 3.6 SOLDERING PROFILE

The LGA package follows the reflow soldering classification profiles described in *Joint Industry Standard, Moisture/Reflow Sensitivity Classification for Nonhermetic Surface Mount Devices*, document number J-STD-020E. Reflow soldering has a peak temperature ($T_p$) of 260ºC

## 3.7 SHIPPING AND HANDLING GUIDELINES

Shipping and handling follow the standards described in *Joint Industry Standard, Handling, Packing, Shipping and Use of Moisture/Reflow Sensitive Surface Mount Devices*, document number J-STD-033C.

The following are additional handling guidelines (refer to the MEMSIC document, PCB Design, Device Handling and Assembly Guidelines, for more information):

- While the mechanical sensor is designed to handle high-g shock events, direct mechanical shock to the package should be avoided.
- SMT assembly houses should use automated assembly equipment with either plastic nozzles or nozzles with compliant tips (for example, soft rubber or silicone).
- Avoid g-forces beyond the specified limits during transportation.
- Handling and mounting of sensors should be done in a defined and qualified installation.

## 3.8 MOISTURE SENSITIVITY LEVEL CONTROL

The moisture sensitivity level is 1 for this product. The following are storage recommendations (refer to the MEMSIC document, PCB Design, Device Handling and Assembly Guidelines, for more information):

- Store the tape and reel in the *unopened* dry pack, until required on the assembly floor.
- If the dry pack has been opened or the reel has been removed from the dry pack, reseal the reel inside of the dry pack with a black protective belt. Avoid crushing the tape and reel.
- Store the cardboard box in a vertical position.



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# 4. SPECIFICATIONS

## 4.1 ABSOLUTE MAXIMUM RATINGS

Parameters exceeding the Absolute Maximum Ratings may permanently damage the device.

| Parameter | Condition | Minimum | Maximum | Unit |
|---|---|---|---|---|
| Supply Voltages | VDD/VDDIO | -0.3 | +3.6 | V |
| Ambient operating temperature | $T_{OP}$ | -40 | +85 | ºC |
| Storage temperature | $T_{STG}$ | -40 | +125 | ºC |
| Mechanical Shock | Duration ≤ 200 μs | - | 10,000 | g |
| | Duration ≤ 1.0ms | - | 3,000 | g |
| ESD | HBM | ± 2000 | - | V |
| | CDM | ± 500 | - | V |
| Latch-up current at $T_{op}$ = 25 ºC | $I_{LU}$ | - | 100 | mA |

**Table 4: Absolute Maximum Ratings**

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## 4.2 SENSOR CHARACTERISTICS

Specifications based on the following conditions: VDD/VDDIO 1.8V, ODR 100Hz, and T = 25°C unless stated otherwise.

| Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Accel FSR | Selectable | | | ±2/4/8/16 | | g |
| Sensitivity | FSR = ±2.0g | | | 16384 | | LSB/g |
| | FSR = ±4.0g | | | 8192 | | |
| | FSR = ±8.0g | | | 4096 | | |
| | FSR = ±16.0g | | | 2048 | | |
| Sensitivity error | | | | ±1 | | % |
| Sensitivity Temperature Coefficient(1) | -40≤ Top ≤ +85 $^0$C | | | ±0.025 | | %/$^0$C |
| Zero-g Offset | Chip Level | | | ±40 | | mg |
| | Board Level | | | ±80 | | |
| Zero-g Offset Temperature Coefficient(1) | -40 ~ 85°C Board Level | | | ±1 | | mg/°C |
| Noise Density | Chip Level (High performance) | | | X/Y=150 Z=240 | | μg/√Hz |
| RMS Noise | Chip Level (low power mode, ODR=50Hz) | | | 6 | | mg |
| Nonlinearity (1) | FSR = ±2.0g | | | 0.6 | | %FS |
| Cross-axis Sensitivity (1) | Between any two axes | | | ±2 | | % |
| Output Data Rate | | | 1 | | 1600 | Hz |

1 Values are based on device characterization, not tested in production.

**Table 5: Accel Sensor Characteristics**



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## 4.3 ELECTRICAL CHARACTERISTICS

| Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Supply voltage (VDD) | Rise-time<30mSec | 1.71 | 1.8 | 3.6 | V |
| Supply for IO (VDDIO) | | 1.08 | 1.2 | VDD | V |
| Sleep current | | | 1.5 | | μA |
| Current consumption | High performance mode (1600 Hz) | | 170 | | μA |
| | Low-power mode (100Hz) | | 10 | | μA |
| Startup Time (Boot to Ready) | VDD > 1.71V | | 3 | | ms |
| Start-up time | | | 3 | | ms |
| Low-level output voltage (Vol) | SDO, INT1 or INT2, Iol < 2mA | 0 | - | 0.3*VDDIO | V |
| High-level output voltage (Voh) | SDO, INT1 or INT2, Iol < 2mA | 0.7*VDDIO | - | VDDIO | V |
| Operating temperature range | | -40 | | 85 | °C |

**Table 6: Electrical Characteristics**

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## 4.4 COMMUNICATION INTERFACE CHARACTERISTICS

### 4.4.1 SPI - SERIAL PERIPHERAL INTERFACE

The device always operates as an SPI slave. An SPI master must initiate all communication and data transfers and generate the SCK_SCL clock that synchronizes the data transfer. The CSN pin must be pulled up to VDDIO when the SPI interface is not in use. The SPI interface can operate in 3-wire or 4-wire mode (default). To enable 3-wire mode, connect the SPI DIN pin to the SPI DOUT pin on the PCB.

#### 4.4.1.1 SPI PROTOCOL

The general protocol for the SPI interface is shown in the figure below. **Each transaction requires a minimum of 24 cycles of the SPI_CLK.** The falling edge of SPI_CS initiates the start of the SPI bus cycle. When the SPI master is writing data to MXC3439ALA via the SPI_DIN pin, data may change when the SPI_CLK is low and must be stable on the rising edge. Similarly, output data written from MXC3439ALA to the SPI master is shifted out on the SPI_DOUT pin on the falling edge of SPI_CLK and can be latched by the master on the rising edge of SPI_CLK. Serial data in or out of the device is always MSB first.

A total of 8-address bits is required for each SPI bus cycle. The first byte of the transaction is the command/address byte. During clock ‘1’, the R/W# bit is set to ‘0’ for a write cycle or ‘1’ for a read cycle. Clocks 2 to 8 specify the address to be written to or read from. Following clock 8, clocks 9-16 shift in the second address byte where clock 9 is address bit A7. Any clocks following 16 are for writing or reading data.

When the SPI master is writing data, data may change when the clock is low, and must be stable on the clock rising edge. Similarly, output data written to the SPI master is shifted out on the falling edge of clock and can be latched by the master on the rising edge of the clock. Serial data in or out of the device is always MSB first.

#### 4.4.1.2 SINGLE REGISTER WRITE

A single register write consists of a 24 (one byte address) clock transaction. As described above, the first bit is set to ‘0’ indicating a register write followed by the register address. The 8th address bit A7 is at bit 9 of the transaction.

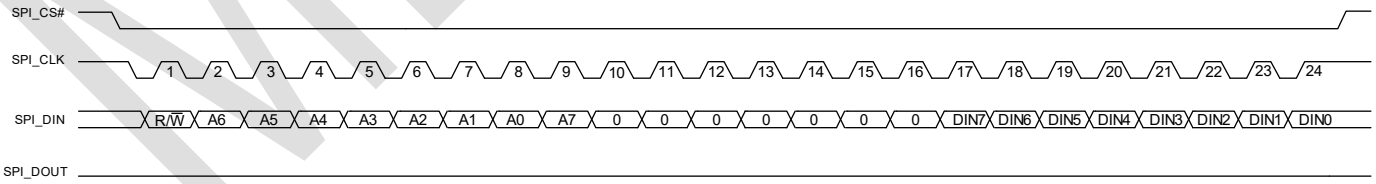



**Figure 11: SPI single register write cycle**



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#### 4.4.1.3 BURST REGISTER WRITE

A burst or multi-byte register write cycle uses the address specified at the beginning of the transaction as the starting register address. Internally the address will auto-increment to the next consecutive address for each additional byte (8-clocks) of data written beyond clock 24.

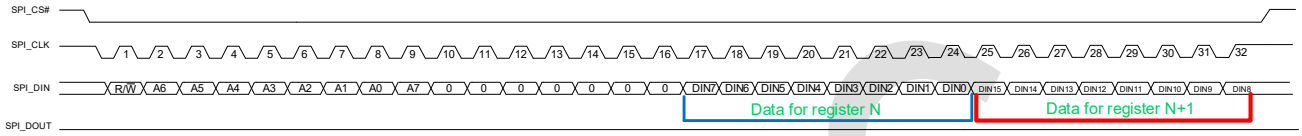



**Figure 12: SPI Burst register write cycle (2 registers)**

#### 4.4.1.4 SINGLE REGISTER READ

A single register write consists of a 24 (two-byte address) clock transaction. As described above, the first bit is set to '1' indicating a register write followed by the register address.

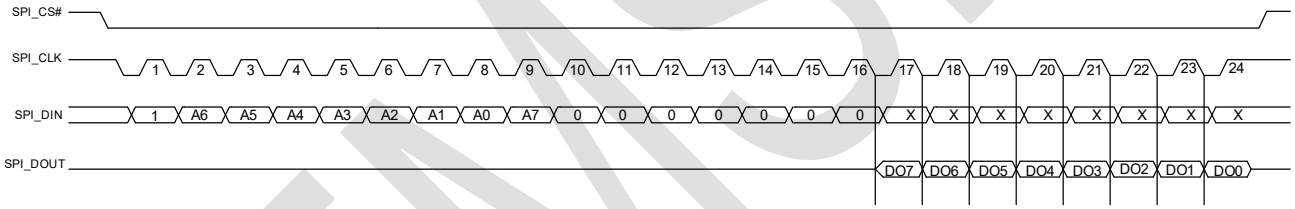



**Figure 13: SPI single register read cycle**

#### 4.4.1.5 BURST REGISTER READ

A burst or multi-byte register read cycle uses the address specified at the beginning of the transaction as the starting register address. Internally the address will auto-increment to the next consecutive address for each additional byte (8-clocks) of data read beyond clock 24.

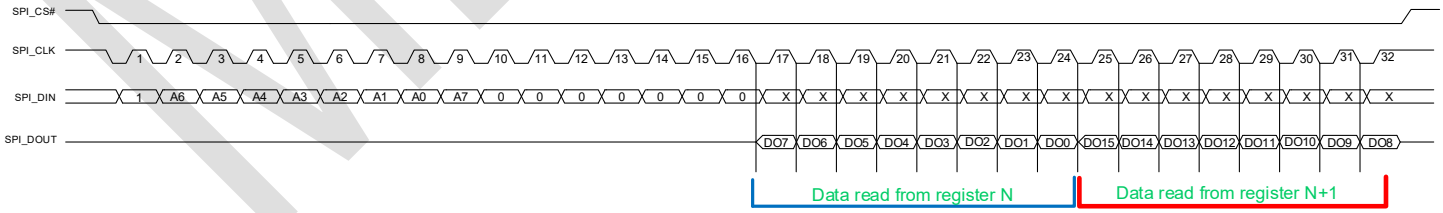



**Figure 14: SPI Burst register read cycle (2 registers)**



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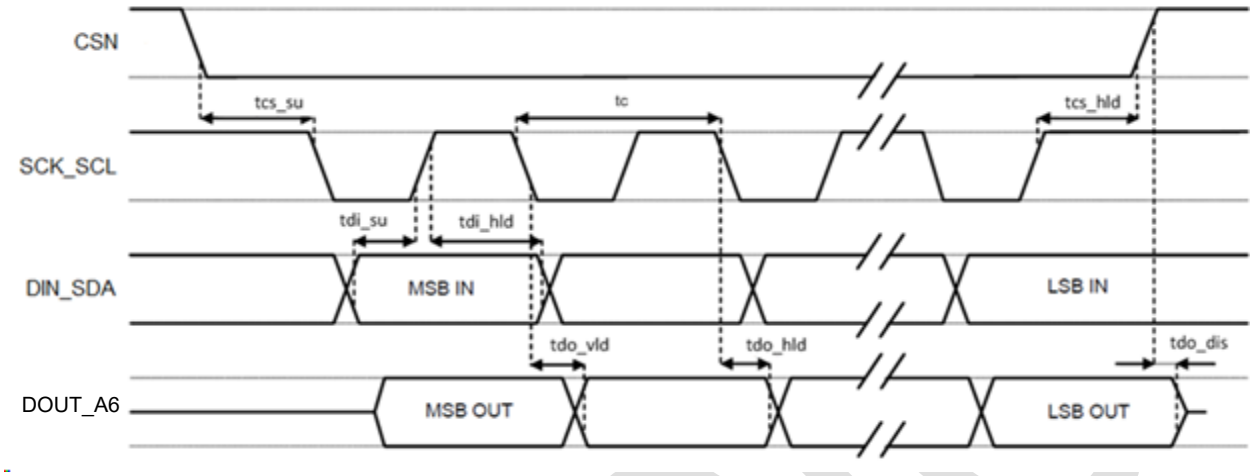



**Figure 15: SPI Timing Waveform**

| Symbol | Parameter | Value | | Units |
|---|---|---|---|---|
| | | Min | Max | |
| tc | SPI SCK_SCL Clock Cycle | 100 | | ns |
| fc | SPI SCK_SCL Clock Frequency | | 10 | MHz |
| tcs_su | SPI CSN Setup Time | 6 | | ns |
| tcs_hld | SPI CSN Hold Time | 8 | | ns |
| tdi_su | SPI DIN_SDA Input Setup Time | 5 | | ns |
| tdi_hld | SPI DIN_SDA Input Hold Time | 15 | | ns |
| tdo_vld | SPI DOUT_A6 Valid Output Time | | 50 | ns |
| tdo_hld | SPI DOUT_A6 Output Hold Time | 9 | | ns |
| tdo_dis | SPI DOUT_A6 Output Disable Time | | 50 | ns |

**Table 7: SPI Timing Parameters**



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### 4.4.2 I2C COMMUNICATIONS INTERFACE

The I2C device address depends upon the state of the SDO pin during power-up as shown in the table below.

| 7-bit Device ID | 8-bit Address - Write | 8-bit Address - Read | SDO level upon power-up |
|---|---|---|---|
| 0x4C<br>(7'b1001100) | 0x98 | 0x99 | GND |
| 0x6C<br>(7'b1101100) | 0xD8 | 0xD9 | VDD |

**Table 8: I2C Address Selection**

I2C/I3C target operating in I2C mode only. Timing is based on the I2C specification and not tested in production.

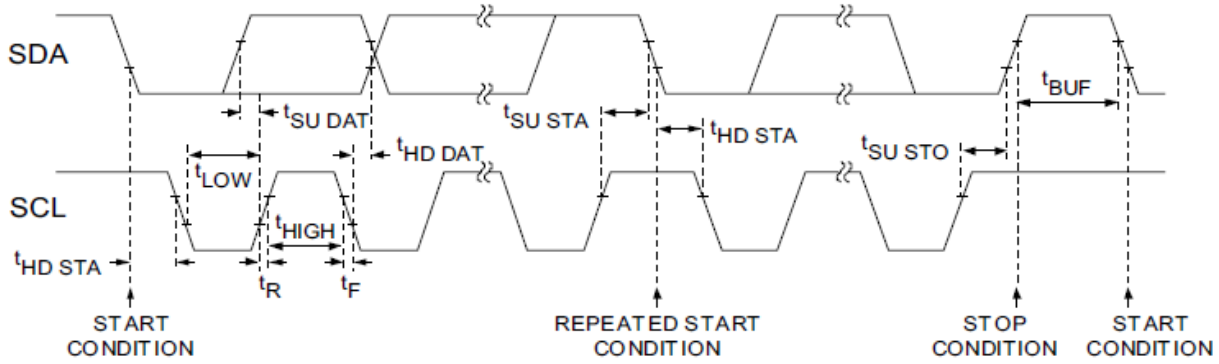



**Figure 16. I2C Interface Timing**

| Parameter | Description | Standard Mode | | Fast Mode | | Fast Mode Plus | | Units |
|---|---|---|---|---|---|---|---|---|
| | | Min | Max | Min | Max | Min | Max | |
| $f_{SCL}$ | SCL clock frequency | 0 | 100 | 0 | 400 | 0 | 1000 | kHz |
| $t_{HD;\ STA}$ | Hold time (repeated) START condition | 4.0 | - | 0.6 | - | 0.26 | - | µs |
| $t_{LOW}$ | LOW period of the SCL clock | 4.7 | - | 1.3 | - | 0.5 | - | µs |
| $t_{HIGH}$ | HIGH period of the SCL clock | 4.0 | - | 0.6 | - | 0.26 | - | µs |
| $t_{SU;STA}$ | Set-up time for a repeated START condition | 4.7 | - | 0.6 | - | 0.26 | - | µs |
| $t_{HD;DAT}$ | Data hold time [1] | 0[2] | - [3] | 0[2] | - [3] | 0.9 | - | µs |
| $t_{SU;DAT}$ | Data set-up time | 250 | - | 100 | - | 50 | - | ns |
| $t_{SU;STO}$ | Set-up time for STOP condition | 4.0 | - | 0.6 | - | 0.26 | - | µs |
| $t_{BUF}$ | Bus free time between a STOP and START | 4.7 | - | 1.3 | - | 0.5 | - | µs |

**Table 9: I2C Timing Characteristics**



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1. $t_{HD;DAT}$ is the data hold time that is measured from the falling edge of SCL, applies to data in transmission and the acknowledge.
2. A device must provide a hold time of at least 300 ns for the SDA signal (with respect to the Vih(min) of the SCL signal) to bridge the undefined region of the falling edge of SCL.
3. The maximum $t_{HD;DAT}$ could be 3.45 μs and 0.9 μs for Standard-mode and Fast-mode, but must be less than the maximum of $t_{VD;DAT}$ or $t_{VD;ACK}$ by a transition time. This maximum must only be met if the device does not stretch the LOW period ($t_{LOW}$) of the SCL signal. If the clock stretches the SCL, the data must be valid by the set-up time before it releases the clock. (Note $t_{VD;DAT}$(max) = $t_{VD;ACK}$(max) are 3.45 μs and 0.9 μs for Standard-mode and Fast-mode). Refer to the I2C Specification for more information.

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### 4.4.3 I3C COMMUNICATIONS INTERFACE

I2C/I3C target operating in I3C mode only.

| Parameter | Symbol | Test Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Logic Input Low Level | $V_{IL}$ | | -0.5 | | 0.3* $V_{IO}$ | V |
| Logic Input High Level | $V_{IH}$ | | 0.7*$V_{IO}$ | | $V_{IO}$ | V |
| Hysteresis of Schmitt input | $V_{hys}$ | | 0.2 | | | V |
| Logic Output Low Level | $V_{OL}$ | | | | 0.3* $V_{IO}$ | V |
| Input Leakage Current | $I_i$ | 0.1$V_{IO}$<$V_{in}$<0.9$V_{IO}$ | -10 | | 10 | μA |
| SCL Clock Frequency | $f_{SCL}$ | | 0.01 | | 7 | MHz |
| START Hold Time | $t_{HD;STA}$ | | 38.4 | | | ns |
| START Setup Time | $t_{SU;STA}$ | | 19.2 | | | ns |
| LOW period of SCL | $t_{LOW}$ | | 33 | | | ns |
| HIGH period of SCL | $t_{HIGH}$ | | 33 | | | ns |
| Data Hold Time | $t_{HD;DAT}$ | | 0 | | 24 | ns |
| Data Setup Time | $t_{SU;DAT}$ | | 3 | | | ns |
| Rise Time | $t_r$ | From $V_{IL}$ to $V_{IH}$ | | | 12 | ns |
| Fall Time | $t_f$ | From $V_{IH}$ to $V_{IL}$ | | | 12 | ns |
| Clock in to data out | tsco | | | | 12 | ns |
| Bus Free Time Between STOP and START | $t_{BUF}$ | | 1.3 | | | μs |
| STOP Setup Time | $t_{SU;STO}$ | | 19.2 | | | ns |

**Table 10: I3C Timing Parameters**



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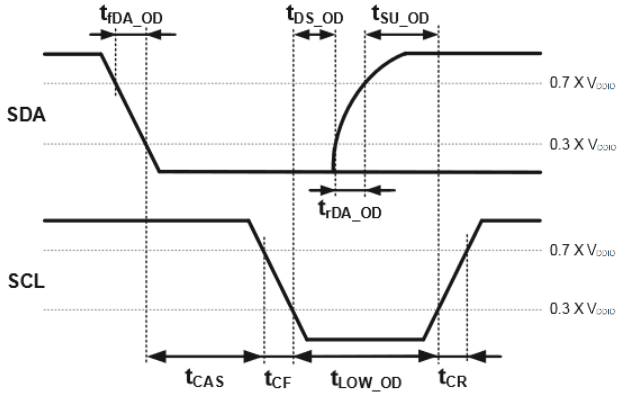



**Figure 17: I3C START Condition Timing**

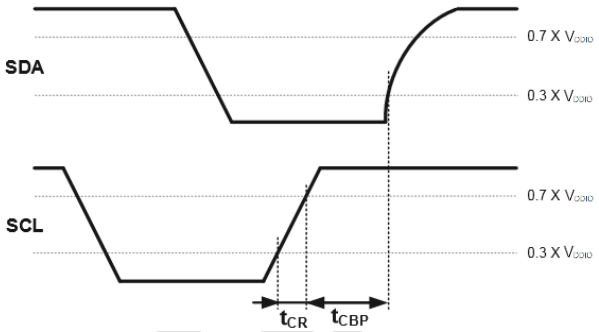



**Figure 18: I3C STOP Condition Timing**

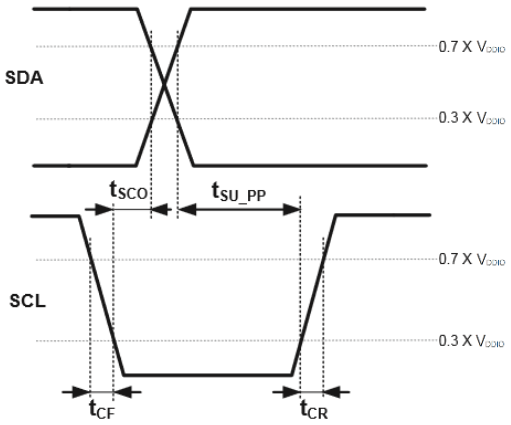



**Figure 19: I3C Target Out Timing**



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# 5 GENERAL OPERATION

The MXC3439ALA is a three-axis MEMS accelerometer. supports low power and low noise operational modes. The MXC3439ALA communicates with the MPU/MCU through I2C (1 MHz), I3C (12.5 MHz), or SPI (10 MHz).

The MXC3439ALA features a motion block which implements algorithms to support many detection features such as “Any-Motion”, “No-Motion”, “Shake”, “Tilt/Flip”, “Tap/Double Tap/Triple Tap”, “6D Orientation”, and “Freefall”. The MXC3439ALA has two external interrupt pins (INT1, INT2). Any interrupt source may be assigned to either pin.

I2C Address:

| 7-bit Device ID | 8-bit Address – Write | 8-bit Address – Read | DOUT_A6 level upon power-up |
|---|---|---|---|
| 0x4C (0b1001100) | 0x98 | 0x99 | GND |
| 0x6C (0b1101100) | 0xD8 | 0xD9 | VDD |

**Table 11: I2C Address Selection**

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## 5.1 OPERATING MODES

The device has three states of operation: SLEEP, STANDBY, WAKE (Low power mode and High-performance mode). All states are controlled by the software, there is no automatic power control.

The device defaults to the SLEEP state following a power-up and must be in the WAKE state before executing a reset.

The time to change from the STANDBY to WAKE state takes one sample period (takes less than 10 μs).

| State | I2C/I3C/SPI Bus | Description |
|---|---|---|
| SLEEP | R/W | • Internal clocking is halted<br>• No motion detection, sampling, or calibration<br>• The I2C/I3C/SPI bus can read and write to registers (resolution, range, thresholds and other settings can be changed)<br>• Reset not allowed<br>• Default state after a power-up |
| STANDBY | R/W | • Internal clocking is enabled<br>• No motion detection, sampling, or calibration<br>• The I2C/I3C/SPI bus can read and write to registers (resolution, range, thresholds and other settings can be changed)<br>• Reset allowed |
| WAKE | R | • WAKE mode<br>➢ Low power mode.<br>➢ High-performance mode: Highest power consumption.<br>• Internal clocking is enabled<br>• Continuous motion detection and sampling; automatic calibration is available<br>• The I2C/I3C/SPI bus can only write to the mode register and read all other registers<br>• Reset allowed |

**Table 12: Operating Modes**



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# 6 REGISTERS

## 6.1 REGISTER DESCRIPTIONS

The resister set is accessed by the I2C, I3C or SPI interfaces.

### 6.1.1 0X00 - CHIP ID REGISTER

The Chip ID register returns the value of 0xFA.

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| 0x00 | Chip ID Register CHIPID_REG | CHIP_ID[7:0] | | | | | | | | 0xFA | RO |

### 6.1.2 0X01 - VERSION REGISTER

The Version ID register contains the current revision code of the MXC3439ALA.

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| 0x01 | Version ID Register VERID_REG | VER_ID[7:0] | | | | | | | | 0x00 | RO |

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### 6.1.3 0X02 – POWER CONTROL/RESET REGISTER

| Addr | Name/Desc. | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| **0x02** | **PWR_CTRL_RST_REG Power Control/Reset Register** | POR_RESET | **RESV** | FIFO_RESET | XL_RESET | HOLD_DISABLE | OTP_PWR_EN | FIFO_PWR_EN | XL_PWR_EN | 0x00 | R/W |

| Bit | Name | Description |
|---|---|---|
| **0** | XL_PWR_EN | 0: XL VDD power is disabled (default).<br>1: XL VDD power is enabled.<br>This bit enables power to the XL/WAKE power domain.<br><br>**If the PWR_MODE[2:0] bits in register 0x05 are configured as LP2 or LP3 for duty-cycle sampling of the XL power domain, this bit should be '0' so that the XL state machine can automatically manage the power. Use the WAKE operational mode in register 0x04 to enable XL operation.**<br><br>**Also see register 0x56 bit 1, DIS_XL_AUTO_RESET (section 6.1.56).** |
| **1** | FIFO_PWR_EN | 0: FIFO VDD power is disabled (default).<br>1: FIFO VDD power is enabled.<br>This bit enables power to the FIFO control logic and storage. |
| **2** | OTP_PWR_EN | 0: OTP VDD power is disabled (default).<br>1: OTP VDD power is enabled.<br>This bit enables power to the OTP core. |
| **3** | HOLD_DISABLE | 0: Holding/isolation cells are enabled (default).<br>1: Holding/isolation cells are disabled.<br><br>When a power domain is disabled, any output signals from that domain are held at known levels (usually logic '0'). T**his bit must be set to '1' to allow signals from the XL or FIFO power domains to pass into the SYS power domain**. Note this bit will not release the holding cells if power is not applied to the XL or FIFO domains. |
| **4** | XL_RESET | 0: XL reset is not asserted (default).<br>1: XL reset is asserted.<br><br>This active high reset must be set and cleared by software. |
| **5** | FIFO_RESET | 0: FIFO reset is not asserted (default).<br>1: FIFO reset is asserted.<br><br>This active high reset must be set and cleared by software. |
| **6** | RESV | Reserved. |
| **7** | POR_RESET | 0: POR reset is not asserted (default).<br>1: POR reset is asserted.<br><br>This active high reset will execute a POR/boot reset. |

**Table 6-1: Register Pg0 0x02 bit assignments**



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### 6.1.4 0X03 – DEVICE STATUS REGISTER

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| **0x03** | **DEV_STATUS Device Status 3 Register** | BOOT_ STATUS | **RESV** | FIFO_ HOLD_ STATUS | XL_HOLD_ STATUS | **RESV** | OTP_PWR_ GOOD | FIFO_PWR _GOOD | XL_PWR_ GOOD | 0x30 | RO |

| Bit | Name | Description |
|---|---|---|
| **0** | XL_PWR_GOOD | 0: XL power is disabled (default).<br>1: XL power status is good. |
| **1** | FIFO_PWR_GOOD | 0: FIFO power is disabled (default).<br>1: FIFO power status is good. |
| **2** | OTP_PWR_GOOD | 0: OTP power is disabled (default).<br>1: OTP power status is good. |
| **3** | **RESV** | Reserved |
| **4** | XL_HOLD_ STATUS | 0: XL holding/isolation cells are not in hold.<br>1: XL holding/isolation cells are in hold (default).<br>Enabling XL power in register 0x02 bit 0 and setting 0x02 bit 3 will disable the holding cells and clear this status bit. |
| **5** | FIFO_HOLD_STATUS | 0: FIFO holding/isolation cells are not in hold.<br>1: FIFO holding/isolation cells are in hold (default).<br>Enabling FIFO power in register 0x23 bit 2 and setting 0x23 bit 3 will disable the holding cells and clear this status bit. |
| **6** | **RESV** | Reserved |
| **7** | BOOT_STATUS | 0: Boot is in completed (default).<br>1: Boot is in progress. |

**Table 6-2: Register 0x03 assignments**



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### 6.1.5 0X04 – CONTROL REGISTER 1

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| 0x04 | CTRL_REG_1 Control Register 1 | TEMP_ SENSE_EN | Z_PD | Y_PD | X_PD | SLOW_CLK[1:0] | | STATE[1:0] | | 0x00 | R/W |

| Bit | Name | Description |
|---|---|---|
| 1:0 | STATE[1:0] | 00: SLEEP Mode (default)<br>01: WAKE Mode<br>10: SELF TEST Mode<br>11: STANDBY Mode<br>The STATE bits set the operation mode for Atria. |
| 3:2 | SLOW_CLK[1:0] | 00: Slow clock is SYS_OSC / 32 (default)<br>01: Slow clock is SYS_OSC / 64<br>10: Slow clock is SYS_OSC / 128<br>11: Slow clock is SYS_OSC / 256<br>This selects the frequency of the 'slow clock' when dynamic clock switching is enabled. Register 0x05 bit 7 must be set to '1' for the dynamic clock switching feature to be enabled. |
| 4 | X_PD | 0: X-channel is enabled in WAKE mode. (default)<br>1: X-channel is disabled. |
| 5 | Y_PD | 0: Y-channel is enabled in WAKE mode. (default)<br>1: Y-channel is disabled. |
| 6 | Z_PD | 0: Z-channel is enabled in WAKE mode. (default)<br>1: Z-channel is disabled. |
| 7 | TEMP_SENSE_EN | 0: Temperature sensor is disabled. (default)<br>1: Temperature sensor is enabled. |

| SLOW_CLK[1:0] | SYS_OSC = 1.6 MHJz | SYS_OSC = 200 kHz |
|---|---|---|
| 00 | 50 kHz | 6.25 KHz |
| 01 | 25 kHz | 3.125 kHz |
| 10 | 12.5 kHz | 1.5625 kHz |
| 11 | 6.25 kHz | 0.78125 kHz |

**Table 6-3: Register 0x04 assignments**



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#### 6.1.5.1 SLEEP MODE

SLEEP mode is the default mode following a POR or soft-reset. Note configuring SLEEP mode in register 0x04 does not override the power domain controls in register 0x02.

#### 6.1.5.2 WAKE MODE

WAKE mode is used for continuous or duty-cycled sampling of the XL. If the PWR_MODE[2:0] bits are configured in register 0x05, the XL power domain may be power-cycled automatically between samples.

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### 6.1.5.3 SELF-TEST MODE

The self -test mode uses the 'tilt and release' feature of the MEMS to capture data and write it to the FIFO. The self-test data captured only comes from the sinc filter output. The following table shows basic usage of the self-test mode.

| Step | Description | Operation |
|---|---|---|
| 0 | Enable power domains<br>FIFO on, XL on, HOLD_DISABLE | W: 0x02 <= 0x0B |
| 1 | Enable FIFO | W: 0x13 <= 0x60 |
| 2 | Set oscillator frequency<br>(recommend 1.6 MHz). | W: 0x05 <= 0x00 |
| 3 | Go to STANDBY mode | W: 0x04 <= 0x03 |
| 4 | Set OSR (OSR 64). | W: 0x06 <= 0x10 |
| 5 | Set SINC filter level (SINC2 in this example). | W: 0x07 <= 0x00 |
| 6 | Set the decimation count to SINC order + 1. | W: 0x22 <= 0x00 |
| 7 | Set TILT hold time. This is approximately 10ms. | W: 0x92 <= 0x20 |
| 8 | Set the self-test sample ignore count (defaults to 20 decimal). | W: 0x94 <= 0x14 |
| 9 | Select the channel for self-test, X-axis in this example. | W: 0x9C <= 0x01 |
| 10 | Set the self-test detection threshold. | W: 0xAB <= LSB<br>W: 0xAC <= MSB |
| 11 | Set the self-test detection interrupt.<br>Disable and clear all interrupts, the enable self-test interrupt. | W: 0x24 <= 0x00<br>W: 0x10 <= 0xFF<br>W: 0x11 <= 0xFF<br>W: 0x24 <= 0x01 |
| 12 | Execute self-test | W: 0x04 <= 0x02 |
| 13 | Poll register 0x18 until FIFO full transitions to '1' (bit 1) | R: 0x18 <= 0xXX<br>…<br>R: 0x18 <= 0x03 |
| 14 | Another way to detect the self-test interrupt to check that FIFO is full and self-test is terminated. | R: 0x10 <= 0x01 |
| 15 | Read self-test detection results | R: 0x12 <= bit[0]<br>0: fail 1: Pass |
| 16 | Read contents of FIFO, 96 16-bit samples of X-data. | for loop = 1 to 32:<br>burst_read(0x19,0x1A,0x1B,0x1C,0x1D,0x1E) |



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| | | |
|---|---|---|
| **17** | Return to STANDBY state to reset XL state machine. | W: 0x04 <= 0x03 |

**Table 6-4: Self-test basic operation**

#### 6.1.5.4 STANDBY MODE

STANDBY mode is defined as no active XL sampling, but the system oscillator/clock is running. This is useful for trimming analog reference currents/voltage and the system oscillator. Note configuring STANDBY mode in register 0x04 does not override the power domain controls in register 0x02.

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## 6.1.6 0X05 – CONTROL REGISTER 2

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| **0x05** | **CTRL_REG_2 Control Register 2** | DUTY_CYC_CLK_EN | CLK_SEL[2:0] | | | LOW_PWR_EN | PWR_MODE[2:0] | | | 0x00 | R/W |

| Bit | Name | Description | | | |
|---|---|---|---|---|---|
| **2:0** | PWR_MODE[2:0] | **PWR_MODE[2:0]** | **Sampling Mode** | **Analog Power Management** | **Digital Power Management** |
| | | 000 (Normal) | Duty Cycled | Disabled | Disabled |
| | | 001 (LP1) | Duty Cycled | Enabled | Disabled |
| | | 010 (LP2) | Duty Cycled | Disabled | Enabled |
| | | 011 (LP3) | Duty Cycled | Enabled | Enabled |
| | | 100 (High Power) | Continuous | None | None |
| | | PWR_MODE[2:0] selects the sampling mode and power management mode. If motion detection features are to be used select Normal, LP1, or High-Power modes.<br><br>**If the PWR_MODE[2:0] bits are configured for duty-cycle sampling of the XL power domain, register 0x02 bit 0 should be '0' so that the XL state machine can automatically manage the power.**<br><br>**Also see register 0x56 bit 1, DIS_XL_AUTO_RESET (section 6.1.56).** | | | |
| **3** | LOW_ANA_PWR_EN | 0: Additional analog low power features disabled (default). (See reg 0x88 bits 4:3)<br>1: Additional analog low power features enabled.<br><br>When this bit is enabled, additional analog features can be added to the analog power management in PWR_MODEs 0-3 above. Normally, only the ADC/SDMs are disabled between samples. Register 0x88 bit 3 allows the ALDO (analog LDO) to be disabled, and 0x88 bit 4 allows the IBIAS generator to be disabled. Note there are performance tradeoffs for more aggressive power management. | | | |
| **6:4** | CLK_SEL[2:0] | Select the main clock frequency. The main clock divider generates the corresponding frequency as shown below. Note there are two SYS_OSC frequencies from the analog.<br><br>This clock frequency is used for active sampling. If 0x05 bit 7 (clock duty cycling) is enabled, the clock frequency used between sampling is determined by register 0x04 bits 3:2. | | | |
| | | **CLK_SEL[2:0]** | **SYS_OSC = 1.6 MHz (Reg 0x20 bit 6 = 0)** | **SYS_OSC = 200 kHz (Reg 0x20 bit 6 = 1)** | **Notes** |
| | | 000 | 1.6 MHz | 200 kHz | |
| | | 001 | 800 kHz | 100 kHz | |
| | | 010 | 400 kJz | 50 kHz | |
| | | 011 | 200 KHz | 25 kHz | |



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| | | | | | |
|---|---|---|---|---|---|
| | | 100 | 72.727 kHz | 9.091 kHz | |
| | | 101 | 32 kHz | 4 kHz | |
| | | 110 | 32 kHz | 4 kHz | |
| | | 111 | 16 kHz | 2 kHz | |
| **7** | DUTY_CYC_CLK_EN | 0: Duty cycle clock feature is disabled (default).<br>1: Duty cycle clock feature is enabled.<br>This feature allows the system clock frequency to be slowed between active samples. This option lowers overall device power and is required to reach the lowest power modes. This bit must be selected before entering LP1/2/3 low power modes. | | | |

**Table 6-5: Register 0x05 assignments**

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### 6.1.6.1 POWER MODES VS SINC/SDM MODES

| 0x05 [2:0] PWR_MODE | Sampling Mode | Analog Power Management | Digital Power Management |
|---|---|---|---|
| **000 (Normal)** | Duty Cycled | Disabled | Disabled |
| **001 (LP1)** | Duty Cycled | Enabled | Disabled |
| **010 (LP2)** | Duty Cycled | Disabled | Enabled |
| **011 (LP3)** | Duty Cycled | Enabled | Enabled |
| **100 (LN, low noise)** | Continuous | None | None |

**Table 6-6: Power Modes**

| No. | Pwr Mode | Sinc/SDM Mode | OSR XY | WAF Z | OSR Z | WAF Z | XY vs Z | IDR | Comment |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Ultra low power mode | LPA | osr1 | 1/bypass | osr1 | 1/bypass | Non-Overlap | x=y=z | IDR=ODR |
| 2 | low power mode WAF | LPA | osr1 | waf_1 | osr1 | waf_1 | | x=y=z | IDR=ODR |
| 3 | double z low power mode | LPB | osr1 | 1/bypass | osr1 | 2 | | x=y=z | IDR=ODR |
| 4 | double z low powr mode WAF | LPB | osr1 | waf1 | osr1 | waf1*2 | | x=y=z | IDR=ODR |
| 5 | double z low noise mode WAF | LPB | osr1 | waf1 (maximum waf) | osr1 | waf1*2 | | x=y=z | IDR=ODR |
| 6 | low power mode (Z-higher WAF) | LPC | osr1 | 1/bypass | osr1 | 4 | Overlap | x=y=z | IDR=ODR |
| 7A | lower noise mode (Z higher WAF) | LPC | osr1 | waf1 | osr1 | waf2 = waf1*2+2 | | x=y=z | IDR=ODR |
| 7B | Low noise mode (Z higher WAF) | LPC | osr1 | Waf1 (maximum waf) | Osr1 | waf2 = waf1*2+2 | | X=y=z | IDR=ODR |
| 8 | lower power mode (higher OSR z) | LPD | osr1 | 1/bypass | osr1*2 | 1/bypass | | x=y=z | IDR=ODR |
| 9A | lowest power mode | LN | osr1 | waf1 | osr2 | waf2 | | y=x y!=z | yIDR=ODR zIDR>=ODR |

**Table 6-7: Power modes vs SINC/SDM sampling modes**



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## 6.1.7 0X06 – CONTROL REGISTER 3

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| 0x06 | CTRL_REG_3 Control Register 3 | RESV | OSR[2:0] | | | XL_G_RANGE[3:0] | | | | 0x10 | R/W |

| Bit | Name | Description | | |
|---|---|---|---|---|
| 3:0 | XL_G_RANGE[3:0] | Select the G-range scaling used for XL X/Y/Z data. Note that the 32g or 48g full range setting will impact TCO and TCS temperature coefficient settings. | | |
| | | **XL_G_RANGE[3:0]** | **G-Range** | **Notes** |
| | | 0x0 | +/-2g | Based on 48g total range |
| | | 0x1 | +/-4g | Based on 48g total range |
| | | 0x2 | +/-8g | Based on 48g total range |
| | | 0x3 | +/-16g | Based on 48g total range |
| | | 0x4 | +/-12g | Based on 48g total range |
| | | 0x5 | +/- 24g | Based on 48g total range |
| | | 0x6, 0x7 | Not used | N/A |
| | | 0x8 | +/-2g | Based on 32g total range |
| | | 0x9 | +/-4g | Based on 32g total range |
| | | 0xA | +/-8g | Based on 32g total range |
| | | 0xB | +/-16g | Based on 32g total range |
| | | 0xC,0xD,0xE,0xF | Not used. | N/A |
| 6:4 | OSR[2:0] | Select the oversampling ratio used by the main sinc filters. This becomes the decimation rate output of the main sinc filters. | | |
| | | **OSR[2:0]** | **Selected OSR** | **Notes** |
| | | 000 | 32 | Sinc filter output rate is Fs/32. |
| | | 001 | 64 | Sinc filter output rate is Fs/64. |
| | | 010 | 125 | Sinc filter output rate is Fs/128. |
| | | 011 | 256 | Sinc filter output rate is Fs/256. |



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| | | | | |
|---|---|---|---|---|
| | | 100 | 512 | Sinc filter output rate is Fs/512. |
| **7** | RESV | Reserved. | | |

**Table 6-8: Register 0x06 assignments**

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### 6.1.8 0X07 – CONTROL REGISTER 4

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| **0x07** | **CTRL_REG_4 Control Register 4** | XL_AVG_ FILTER_XY_ EN | **RESV** | SINC_ODR[1:0] | | LPF_PASS_ THRU_Z | LPF_RESET | LPF_PASS _THRU_XY | LPF_EN | 0x03 | R/W |

| Bit | Name | Description |
|---|---|---|
| **0** | LPF_EN | 0: LPF filter is disabled.<br>1: LPF filter is enabled (default)<br>The 2nd order Butterworth low pass filter is enabled by default. Unique cutoff frequencies Fc require that filter coefficient registers to the programmed.<br>X and Y axis coefficients: registers 0x4E to 0x57<br>Z axis coefficients: registers 0xAD to 0xB4 |
| **1** | LPF_PASS_THRU_XY | 0: LPF XY filter is set to normal mode (requires coefficients to be programmed)<br>1: LPF XY filter is set to pass thru, coefficients are set to '1'.<br>The 2nd order Butterworth low pass filter 'pass-thru' mode allows data to run through the filter with coefficients set to '1'. |
| **2** | LPF_RESET | 0: LPF is not reset (default).<br>1: LPF is reset.<br>The bit resets the registers in the LPF. This reset is an active high level and must be set/cleared by SW. |
| **3** | LPF_PASS_THRU_Z | 0: LPF Z filter is set to normal mode (requires coefficients to be programmed)<br>1: LPF Z filter is set to pass thru, coefficients are set to '1'.<br>The 2nd order Butterworth low pass filter 'pass-thru' mode allows data to run through the filter with coefficients set to '1'. |
| **5:4** | SINC_ODR | 00: SINC filter order is 2. (default)<br>01: SINC filter order is 3. |
| **6** | **RESV** | Reserved. |
| **7** | XL_XY_AVG_FILTER_EN | 0: XL XY averaging filter is disabled (default).<br>1: XL XY averaging filter is enabled. |

**Table 6-9: Register 0x07 assignments**



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### 6.1.9 0X08 TO 0X0D – XL OUTPUT REGISTERS

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| 08 | **XL_XOUT_LSB** | XL_XOUT[7:0] | | | | | | | | 0x00 | RO |
| 09 | **XL _XOUT_MSB** | XL_XOUT[15:8] | | | | | | | | 0x00 | RO |
| 0A | **XL_YOUT_LSB** | XL_XOUT[7:0] | | | | | | | | 0x00 | RO |
| 0B | **XL _YOUT_MSB** | XL_YOUT[15:8] | | | | | | | | 0x00 | RO |
| 0C | **XL _ZOUT_LSB** | XL_ZOUT[7:0] | | | | | | | | 0x00 | RO |
| 0D | **XL _ZOUT_MSB** | XL_ZOUT[15:8] | | | | | | | | 0x00 | RO |

Registers 0x08 to 0x13 contain the signed output values read from the X, Y, and Z accelerometer channels. The values are represented as a signed, 2's compliment 16-bit number. Values will range from 0x8000 (full scale negative) to 0x7FFF (full scale positive). The actual output range will be affected by the selected g-range and the analog gain of the SDM. If the FIFO is enabled, FIFO output data is read from registers 0x19 to 0x1E.

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### 6.1.10 0X0E, 0X0F – TEMPERATURE OUTPUT DATA

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| 0x0E | TEMP_DATA_LSB | TEMP_DATA[7:0] | | | | | | | | 0xE8 | RO |
| 0x0F | TEMP_DATA_MSB | RESV | | | | | TEMP_DATA [10:8] | | | 0x03 | RO |

This register reports the raw temperature sensor output. This value is not corrected or modified for any factory trim values. For the corrected temperature with the factory trim value, use registers 0xA9, 0xAA.

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### 6.1.11 0X10, 0X11 – INTERRUPT STATUS AND CLEAR REGISTERS 1/2

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| **0x10** | **INT_REG_1 Interrupt Status Register 1** | FLIP_ INTR | TF_ INTR | FIFO_ INTR | NO_MOTION_ INTR | SHAKE_ INTR | ANYM_ INTR | XL_SAMPLE_ INTR | SLFTST_ INTR | 0x00 | R |
| **0x10** | **INT_CLR_REG_1 Interrupt Clear Register 1** | FLIP_ INTR_CLR | TF_ INTR_CLR | FIFO_ INTR_CLR | NO_MOTION_ INTR_CLR | SHAKE_ INTR_CLR | ANYM_ INTR_CLR | XL_SAMPLE_ INTR_CLR | SLFTST_ INTR_CLR | 0x00 | W1C |
| | | | | | | | | | | | |
| **0x11** | **INT_CLR_REG_2 Interrupt Status Register 2** | **RESV** | INT1_ MOTION-LESS_INTR | **RESV** | FREEFALL_ INTR | SIXD_INTR | TTAP_INTR | DTAP_INTR | TAP_INTR | 0x00 | R |
| **0x11** | **INT_CLR_REG_2 Interrupt Clear Register 2** | **RESV** | INT1_ MOTION-LESS_CLR | **RESV** | FREEFALL_ INTR_CLR | SIXD_INTR_ CLR | TTAP_INTR_ CLR | DTAP_INTR_ CLR | TAP_INTR_ CLR | 0x00 | W1C |

Registers 0x10 and 0x11 have separate read and write paths. Hardware sets interrupts in this register. To clear an interrupt, write a bitmask with the bit to clear set to '1' to register 0x10 or 0x11 (write 1 to clear, W1C). **There is no need to write a '0' to clear the '1', it is auto-clearing**.

Also note that the corresponding interrupt must be enabled in registers 0x24 or 0x25. Note that FIFO interrupts are serviced in register 0x18.

| Bit | Name | Description |
|---|---|---|
| **0** | SLFTST_INTR_CLR | 0: Self-test interrupt has not been detected.<br>1: Self-test interrupt has been detected.<br>Write '1' to this bit to clear. |
| **1** | XL_SAMPLE_INTR | 0: No new XL sample data has arrived since last read.<br>1: New XL sample data has arrived and has been written to the output registers.<br>Write '1' to this bit to clear. |
| **2** | ANYM_INTR | 0: Any motion event/interrupt is not detected.<br>1: Any motion event/interrupt detected.<br>Write '1' to this bit to clear. |
| **3** | SHAKE_INTR | 0: SHAKE event/interrupt is not detected.<br>1: SHAKE event/interrupt detected. |



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| | | |
|---|---|---|
| **4** | NOMO_INTR | 0: NoMotion event/interrupt not detected<br>1: NoMotion event/interrupt detected.<br>Write '1' to this bit to clear. |
| **5** | FIFO_INTR | 0: No FIFO interrupt has been detected.<br>1: FIFO interrupt has been detected.<br>Write '1' to this bit to clear.<br>Register 0x18 bits 2:0 report which FIFO interrupt condition was triggered (FIFO_EMPTY, FIFO_FULL, FIFO_THRESH). |
| **6** | TILT_INTR | 0: TILT event/interrupt is not detected.<br>1: TILT event/interrupt detected.<br>Write '1' to this bit to clear. |
| **7** | FLIP_INTR | 0: FLIP event/interrupt is not detected.<br>1: FLIP event/interrupt detected.<br>Write '1' to this bit to clear. |

**Table 6-10: Register 0x10 bit assignments**

| Bit | Name | Description |
|---|---|---|
| **0** | TAP_INTR | 0: Tap event/interrupt has not been detected.<br>1: Tap event/ interrupt has been detected.<br>Write '1' to this bit to clear. |
| **1** | DTAP_INTR | 0: Double Tap event/interrupt has not been detected.<br>1: Double Tap event/ interrupt has been detected.<br>Write '1' to this bit to clear. |
| **2** | TTAP_INTR | 0: Triple Tap event/interrupt has not been detected.<br>1: Triple Tap event/interrupt has been detected.<br>Write '1' to this bit to clear. |
| **3** | SIXD_INTR | 0: Change in 6D origination threshold/interrupt not detected.<br>1: Change in 6D origination threshold/interrupt detected.<br>Write '1' to this bit to clear. |
| **4** | FREEFALL_INTR | 0: Freefall event/interrupt has not been detected.<br>1: Freefall event/interrupt has been detected<br>Write '1' to this bit to clear. |
| **5** | **RESV** | Reserved. |
| **6** | MOTIONLESS_INTR | 0: MOTIONLESS interrupt has not been detected.<br>1: MOTIONLESS has been detected<br>Write '1' to this bit to clear. |
| **7** | **RESV** | Reserved. |

**Table 6-11: Register 0x11 bit assignments**



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### 6.1.12 0X12 – SENSOR AND MOTION STATUS REGISTER (STATUS REGISTER)

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| Pg0 0x12 | Status Register 1 | FLIP_FLAG | TF_FLAG | FIFO_FLAG | NO_MO_STAT | SHAKE_FLAG | ANYM_FLAG | NEW_DATA_XL_STAT | SLFTST_STATUS | 0x30 | RO |

Note that Motion register default values such as NO_MO_STAT is set under XL power domain. It needs to enable XL_PWR_EN(Refer to register 0x02 bit0) and to disable hold/isolation cells(Refer to register 0x02 bit3) to get motion register default values.

| Bit | Name | Description |
|---|---|---|
| **0** | SLFTST_STATUS | Shows the results of the XL self-test sequence.<br>0: Self-test not run or fail (default).<br>1: Self-test passed.<br>This is the self-test pass/fail indicator. Refer to register 0x97 bit 7 for the self-test 'done' indicator. |
| **1** | NEW_DATA_XL_STAT | 0: No new sample data has arrived since last read. (default)<br>1: New sample data has arrived and has been written output registers. |
| **2** | ANYM_STAT | 0: Any motion condition is not detected.<br>1: Any motion condition detected. |
| **3** | SHAKE_STAT | 0: SHAKE condition is not detected.<br>1: SHAKE condition detected. |
| **4** | NO_MO_STAT | 0: No Motion condition is not detected.<br>1: No Motion condition is detected. |
| **5** | FIFO_FLAG | 0: No FIFO flags set.<br>1: FIFO flag is set (FIFO full, FIFO empty, FIFO threshold). |
| **6** | TILT_STAT | 0: TILT condition is not detected.<br>1: TILT condition detected. |
| **7** | FLIP_STAT | 0: FLIP condition is not detected.<br>1: FLIP condition detected. |

**Table 6-12: register 0x12 bit assignments**



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### 6.1.13 0X13 – FIFO CONTROL REGISTER 1

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| **0x13** | **FIFO_CTRL_1 FIFO Control Register 1** | **RESV** | FIFO_READ_EN | FIFO_ENABLE | FIFO_STREAM_MODE | **RESV** | FIFO_EMPTY_INTR_EN | FIFO_FULL_INTR_EN | FIFO_THRESH_INTR_EN | 0x00 | R/W |

| Bit | Name | Description |
|---|---|---|
| **0** | FIFO_THRESH_INTR_EN | 0: FIFO threshold feature and interrupt is not enabled. (default)<br>1: FIFO threshold feature and interrupt is enabled. |
| **1** | FIFO_FULL_INTR_EN | 0: FIFO full feature and interrupt is not enabled. (default)<br>1: FIFO full feature and interrupt is enabled. |
| **2** | FIFO_EMPTY_INTR_EN | 0: FIFO empty feature and interrupt is not enabled. (default)<br>1: FIFO empty feature and interrupt is enabled. |
| **3** | **RESV** | Reserved. |
| **4** | FIFO_STREAM_MODE | 0: FIFO stream mode is disabled (default).<br>1: FIFO stream mode is enabled.<br>FIFO stream mode allows the FIFO to capture any new data on the write port, while removing the oldest previously captured sample. |
| **5** | FIFO_ENABLE | 0: FIFO is disabled (default).<br>1: FIFO is enabled.<br>This is the main FIFO enable. Note that the FIFO DVDD domain must be enabled/powered also. |
| **6** | FIFO_READ_EN | 0: FIFO is not in read mode (default).<br>1: FIFO is in read mode.<br>Set this bit to '1' to enable the FIFO_DOUT port in registers 0x19 to 0x1E. |
| **7** | **RESV** | Reserved. |

**Table 6-13: register 0x13 bit assignments**



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### 6.1.14 0X14 – FIFO CONTROL REGISTER 2

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| 0x14 | FIFO_CTRL_2 FIFO Control Register 2 | RESV | RESV | RESV | FIFO_THRESH[4:0] | | | | | 0x00 | R/W |

| Bit | Name | Description |
|---|---|---|
| 4:0 | FIFO_THRESH[4:0] | The FIFO threshold or 'watermark' sets the number of FIFO samples at which the FIFO threshold flag/interrupt is set. |
| 7:5 | RESV | Reserved. |

**Table 6-14: register 0x14 bit assignments**

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### 6.1.15 0X15 – FIFO CONTROL REGISTER 3

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| 0x15 | FIFO_CTRL_3 FIFO Control Register 3 | RESV | RESV | FIFO_ BURST_ READ | FIFO_BURST_LEN[4:0] | | | | | 0x00 | R/W |

| Bit | Name | Description |
|---|---|---|
| 4:0 | FIFO_BURST_LEN [4:0] | The FIFO burst length sets the number of samples to read in a single serial (SPI, I2C, I3C) read transaction. |
| 5 | FIFO_BURST_READ | 0: FIFO burst read mode is not enabled (default).<br>1: FIFO burst read mode is enabled. |
| 7:6 | RESV | Reserved. |

**Table 6-15: register 0x15 bit assignments**



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### 6.1.16 0X16 – FIFO STATUS REGISTER 1

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| **0x16** | **FIFO_STAT_2 FIFO Status Register 1** | FIFO_WPTR[5:4] | | FIFO_RPTR[5:0] | | | | | | 0x00 | RO |

| Bit | Name | Description |
|---|---|---|
| **5:0** | FIFO_RPTR[5:0] | FIFO Read pointer – this reports the current value of the FIFO read pointer. This value may be indeterminant during FIFO stream mode while new samples are being captured to the FIFO. |
| **7:6** | FIFO_WPTR[5:4] | FIFO Write pointer – these bits form bits 5:4 of the 6-bit FIFO_WPTR[5:0] value. |

**Table 6-16: register 0x16 bit assignments**

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### 6.1.17 0X17 – FIFO STATUS REGISTER 2

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| 0x17 | FIFO_STAT_2 FIFO Status Register 2 | WPTR_ STREAM | RPTR_ STREAM | FIFO_SAMPLE_CNT[5:0] | | | | | | 0x00 | RO |

| Bit | Name | Description |
|---|---|---|
| 5:0 | FIFO_SAMPLE_CNT[5:0] | This value reports the number of samples currently stored in the FIFO. Note that this value may dynamically change and samples are written or read to/from the FIFO. |
| 6 | RPTR_STREAM | 0: FIFO read pointer is operating normally.<br>1: FIFO read pointer is operating in stream mode or has not been enabled (default).<br><br>This bit operates only if FIFO_STREAM mode has been enabled - disregard the FIFO read pointer value in register 0x16 bits 5:0.<br><br>If the device is reset or the FIFO has not been initialized, this bit will also be set even through FIFO stream mode is not active. |
| 7 | WPTR_STREAM | 0: FIFO write pointer is operating normally.<br>1: FIFO write pointer is operating in stream mode or has not been enabled (default).<br><br>This bit operates only if FIFO_STREAM mode has been enabled - disregard the FIFO write pointer value in registers 0x16 and 0x18.<br><br>If the device is reset or the FIFO has not been initialized, this bit will also be set even through FIFO stream mode is not active. |

**Table 6-17: register 0x17 bit assignments**



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### 6.1.18 0X18 – FIFO STATUS REGISTER 3

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| 0x18 | FIFO_STAT_3 FIFO Status Register 3 | FIFO_WPTR[3:0] | | | | FIFO_ OVERRIUN | FIFO_ EMPTY | FIFO_FULL | FIFO_ THRESH | 0x04 | RO |

| Bit | Name | Description |
|---|---|---|
| **0** | FIFO_THRESH | 0: FIFO threshold has not been reached (default).<br>1: FIFO threshold has been reached.<br>Note this flag only operates if the FIFO_THRESH_INT_EN bit has been set in register 0x13 bit 0. |
| **1** | FIFO_FULL | 0: FIFO is not full (default).<br>1: FIFO is full.<br>Note this flag only operates if the FIFO_FULL_INT_EN bit has been set in register 0x13 bit 1. |
| **2** | FIFO_EMPTY | 0: FIFO is not empty.<br>1: FIFO is empty (default). |
| **3** | FIFO_OVERRUN | 0: FIFO is not overrun (default)<br>1: FIFO is overrun. |
| **7:4** | FIFO_WPTR[3:0] | FIFO Write pointer – these bits form bits 3:0 of the 6-bit FIFO_WPTR[5:0] value. |

**Table 6-18: register 0x18 bit assignments**



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### 6.1.19 0X19 TO 0X1E – FIFO_DOUT REGISTERS

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| 0x19 | FIFO_XOUT_LSB | FIFO_XOUT[7:0] | | | | | | | | 0x00 | RO |
| 0x 1A | FIFO_XOUT_MSB | FIFO_XOUT[15:8] | | | | | | | | 0x00 | RO |
| 0x 1B | FIFO_YOUT_LSB | FIFO_YOUT[7:0] | | | | | | | | 0x00 | RO |
| 0x 1C | FIFO_YOUT_MSB | FIFO_YOUT[15:8] | | | | | | | | 0x00 | RO |
| 0x1D | FIFO_ZOUT_LSB | FIFO_ZOUT[7:0] | | | | | | | | 0x00 | RO |
| 0x 1E | FIFO_ZOUT_MSB | FIFO_ZOUT[15:8] | | | | | | | | 0x00 | RO |

| Reg/Bit | Name | Description |
|---|---|---|
| **0x19 7:0** | FIFO_DOUT[7:0]<br>FIFO_XOUT[7:0] | Normal Mode:<br>FIFO_DOUT[47:0] – 6 bytes representing data read from the FIFO, each channel X, Y, Z uses 2-bytes.<br><br>Self-Test Mode<br>FIFO_DOUT[47:0] - – 6 bytes representing data read from the FIFO, one channel (X, Y or Z) uses 2-bytes to store 3-samples from the same axis.<br><br>Note that live-data mode or non-FIFO captured data is reported in registers 0x08 to 0x0D. |
| **0x1A 7:0** | FIFO_DOUT[15:8]<br>FIFO_XOUT[15:8] | |
| **0x1B 7:0** | FIFO_DOUT[23:16]<br>FIFO_YOUT[7:0] | |
| **0x1C 7:0** | FIFO_DOUT[31:24]<br>FIFO_YOUT[15:8] | |
| **0x1D 7:0** | FIFO_DOUT[39:32]<br>FIFO_ZOUT[7:0] | |
| **0x1E 7:0]** | FIFO_DOUT[47:40]<br>FIFO_ZOUT[15:8] | |

**Table 6-19: registers 0x19-0x1E bit assignments**



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### 6.1.20 0X1F - ODR DIVIDE REGISTER

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| 0x1F | ODR_DIV ODR Divide Register | ODR_DIV[7:0] | | | | | | | | 0x00 | RW |

| Bit | Name | Description |
|---|---|---|
| **7:0** | ODR_DIV[7:0] | 8-bit divide value used to select the XL output data rate for sampling.<br>The ODR_PRE_CLK frequency, selected by register 0x20 [1:0], is divided by the 8-bit value in register 0x1F. See section 6.1.21.<br>**ODR = ODR_PRE_CLK_SEL / ODR_DIV** |

**Table 6-20: register 0x1F bit assignments**

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### 6.1.21 0X20 – ODR PRESCALE REGISTER

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| **0x20** | **ODR_PRESCALE ODR Prescale Register** | SYS_OSC_EN | SYS_OSC_LOW_EN | **RESV** | OFFSET_SEL | UPD_MODE_SEL | **RESV** | ODR_CLK_SEL[1:0] | | 0x00 | R/W |

| Bit | Name | Description |
|---|---|---|
| **1:0** | ODR_CLK_SEL[1:0] | Select the ODR prescale clock used to generate an ODR. Register 0x1F ODR_DIV[7:0] determines the divide by value of the ODR_PRESCALE clock. For example:<br>• 0x20[1:0] = 10 or 6.25 kHz, Select ODR_CLK_SEL<br>• 0x1F[7:0] = 'd62 (0x3E), Program ODR_DIV value<br>• XL ODR = 6.25 kHz / 62 = ~100.8 Hz, Resulting ODR rate |
| **2** | **RESV** | Reserved |
| **3** | UPD_MODE_SEL | 0: ODR clock determines when the XL output registers are updated (default).<br>1: Output registers are updated by XL pipeline rate (option for continuous mode). |
| **4** | OFFSET_SEL | 0: XL offset selection is registers 0x58 to 0x5D (default).<br>1: XL offset selection is registers 0x5E to 0x61, 0x6C and 0x79. |
| **5** | **RESV** | Reserved |
| **6** | SYS_OSC_LOW | 0: System oscillator frequency is ~1.6 MHz (default).<br>1: System oscillator frequency is ~200 kHz.<br>When the system oscillator frequency is 1.6 MHz, the OTP backed trim value is at register 0x81. When the system oscillator frequency is 200 kHz MHz, the trim value is at register 0x82. During boot, the system oscillator trim is automatically set to 0x50. |
| **7** | SYS_OSC_EN | 0: System oscillator is disabled or under hardware control (register 0x04 bits 1:0) (default).<br>1: System oscillator is manually enabled by this bit.<br>The system oscillator is automatically enabled during STANDBY and WAKE modes, or if the device reset is active. |

| ODR_PRE_CLK[1:0] | SYS_OSC = 1.6 MHz | SYS_OSC = 200 kHz |
|---|---|---|
| 00 (div by 1) | 1.6 MHz | 200 kHz |
| 01 (div by 32) | 50 kHz | 6.25 kHz |
| 10 (div by 256) | 6.250 kHz | 781.25 Hz |
| 11 (div by 16384) | 97.6 Hz | 12.2 Hz |

**Table 6-21: register 0x20 bit assignments**



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## 6.1.22 0X21 – TEMP CONTROL

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| **0x21** | TEMP_CTRL Temp Control Register | TEMP_CAL_EN | TEMP_SENSE_RESET | **RESV** | **RESV** | TCO_TCS_DEBUG[1:0] | | TCS_BYPASS | TCO_BYPASS | 0x00 | R/W |

| Bit | Name | Description |
|---|---|---|
| **0** | TCO_BYPASS | 0: Temperature controlled (compensation) offset adjustment is not bypassed (default).<br>1: Temperature controlled (compensation) offset is bypassed. |
| **1** | TCS_BYPASS | 0: Temperature controlled (compensation) sensitivity adjustment is not bypassed (default).<br>1: Temperature controlled (compensation) sensitivity is bypassed. |
| **3:2** | TCO_TCS_DEBUG [1:0] | **TCO_TCS_DEBUG [1:0] (Select debug output)** / **TCO Debug (0xA6[7:0], 0xA8[4:0])** / **TCS Debug (0xA7[7:0], 0xA8 bit 7)**<br>00 / Disabled / Disabled<br>01 / TCO X-axis Parallel Data TCO_X_PDATA[12:0] / TCS X-axis Parallel Data TCS_X_PDATA[8:0]<br>10 / TCO Y-axis Parallel Data TCO_Y_PDATA[12:0] / TCO Y-axis Parallel Data TCS_Y_PDATA[8:0]<br>11 / TCO Z-axis Parallel Data TCO_Z_PDATA[12:0] / TCO Z-axis Parallel Data TCS_Z_PDATA[8:0] |
| **4** | **RESV** | Reserved. |
| **5** | **RESV** | Reserved. |
| **6** | TEMP_SENSE_RESET | 0: The analog temperature sensor is not reset (default).<br>1: The analog temperature sensor is reset (level). |
| **7** | TEMP_CAL_EN | 0: Temperature sensor calibration is not enabled (default).<br>1: Temperature sensor calibration is enabled. |

**Table 6-22: register 0x21 bit assignments**



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### 6.1.23 0X22 – XL XY DECIMATION REGISTER

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| 0x22 | XL_XY_DEC_REG XL Decimation Register for XY | XL_XY_DEC_COUNT[7:0] | | | | | | | | 0x04 | R/W |

| Bit | Name | Description |
|---|---|---|
| **7:0** | XL_XY_DEC_COUNT[7:0] | Set the decimation count for the XL XY channels; does not apply to Z. The XL XY averaging filter must be enabled for the decimation count to apply (register 0x07 bit 7 = '1'), otherwise the count is set to 1.<br>0x00: Decimation count is 256 (default).<br>0x01-0xFF, decimation count is 1 to 255.<br>Also see register 0x90, the Z-axis decimation count. |

**Table 6-23: register 0x22 bit assignments**



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### 6.1.24 0X23 – INTERRUPT CONTROL REGISTER 0

This register selects which interrupt(s) are connected to the external INT1 and INT2 pads.

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| 0x23 | INT_CTRL_0 Interrupt Control Register 0 | INT2_SEL[3:0] | | | | INT1_SEL[3:0] | | | | 0x00 | R/W |

| Bit | Name | Description |
|---|---|---|
| 3:0 | INT1_SEL[3:0] | Select which interrupt drives the INT1 pad.<br><br>0: Default (XL sample/Motion or **ALL** interrupts), set register 0x26 bit 4 to combine all interrupts)<br>1: **Reserved**<br>2: XL interrupt on sample<br>3: Shake<br>4: AnyMotion/NoMotion<br>5: Flip<br>6: Tilt<br>7: **Reserved**<br>8: Tap<br>9: Double Tap<br>A: Triple Tap<br>B: Freefall<br>C: Six 6D Orientation<br>D: FIFO Interrupt<br>E: Self-Test State Flag<br>F: **Reserved** |
| 7:4 | INT2_SEL[3:0] | Select which interrupt drives the INT2 pad.<br><br>0: Default (FIFO or **ALL** interrupts), set register 0x26 bit 4 to combine all interrupts)<br>1: **Reserved**<br>2: XL interrupt on sample<br>3: Shake<br>4: AnyMotion/NoMotion<br>5: Flip<br>6: Tilt<br>7: **Reserved**<br>8: Tap<br>9: Double Tap<br>A: Triple Tap<br>B: Freefall<br>C: Six 6D Orientation<br>D: FIFO Interrupt<br>E: Self-Test State Flag<br>F: **Reserved** |

**Table 6-24: Register 0x23 bit assignments**



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### 6.1.25 0X24 – INTERRUPT CONTROL REGISTER 1

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| 0x24 | Interrupt Control Register 1 | FLIP_ INT_EN | TILT_ INT_EN | RESV | RESV | SHAKE_ INT_EN | ANYM_ INT_EN | ACQ_XL_ INT_EN | SELF_TEST_ INTR_EN | 0x00 | R/W |

Note that the corresponding motion feature in registers 0x2E or 0x2F must be enabled for the interrupt to actual transition.

| Bit | Name | Description |
|---|---|---|
| **0** | SELF_TEST_INT_EN | 0: Self-Test interrupt is disabled (default)<br>1: Self-Test interrupt is enabled. |
| **1** | ACQ_XL_INT_EN | 0: XL interrupt is disabled (default)<br>1: XL interrupt is enabled. |
| **2** | ANYM_INT_EN | 0: AnyMotion interrupt is disabled (default)<br>1: AnyMotion interrupt is enabled. |
| **3** | SHAKE_INT_EN | 0: Shake interrupt is disabled (default)<br>1: Shake interrupt is enabled. |
| **4** | **RESV** | Reserved. |
| **5** | **RESV** | Reserved. |
| **6** | TILT_INT_EN | 0: TILT interrupt is disabled (default)<br>1: TILT interrupt is enabled. |
| **7** | FLIP_INT_EN | 0: FLIP interrupt is disabled (default)<br>1: FLIP interrupt is enabled. |

**Table 6-25: Register 0x24 bit assignments**



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### 6.1.26 0X25 – INTERRUPT CONTROL REGISTER 2

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| 0x25 | Interrupt Control Register 2 | RESV | MOTION LESS_INTR_ EN | NOMO_ INTR_EN | FREEFALL_ INTR_EN | SIXD_ INTR_EN | TTAP_ INTR_EN | DTAP_ INTR_EN | TAP_ INTR_EN | 0x00 | R/W |

Note that the corresponding motion feature in registers 0x2E or 0x2F must be enabled for the interrupt to actual transition.

| Bit | Name | Description |
|---|---|---|
| 0 | TAP_INTR_EN | 0: TAP interrupt is disabled (default)<br>1: TAP interrupt is enabled. |
| 1 | DTAP_INTR_EN | 0: DTAP interrupt is disabled (default)<br>1: DTAP interrupt is enabled. |
| 2 | TTAP_INTR_EN | 0: TTAP interrupt is disabled (default)<br>1: TTAP interrupt is enabled. |
| 3 | SIXD_INTR_EN | 0: SIXD (6D) interrupt is disabled (default)<br>1: SIXD (6D) interrupt is enabled. |
| 4 | FREEFALL INTR_EN | 0: FREEFALL interrupt is disabled (default)<br>1: FREEFALL interrupt is enabled. |
| 5 | NOMO_INTR_EN | 0: No Motion interrupt is disabled (default).<br>1: No Motion interrupt is enabled. |
| 6 | MOTIONLESS_INTR_EN | 0: Motionless interrupt is disabled (default).<br>1: Motionless interrupt is enabled. |
| 7 | **RESV** | Reserved. |

**Table 6-26: Register 0x25 bit assignments**



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## 6.1.27 0X26 – INT PAD CONTROL REGISTER

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| 0x26 | INT Pad Control Register | RESV | RESV | RESV | COMB_INTR_EN | INT2_PAD _CFG[1:0] | | INT1_PAD_CFG[1:0] | | 0x00 | R/W |

| Bit | Name | Function | Description |
|---|---|---|---|
| 1:0 | INT1_PAD_CFG[1:0] | INT1 pad configuration control. | 00: INT1 pad operates in interrupt request mode as an output (default).<br>01: INT1 pad operates in external trigger mode as an input.<br>10: INT1 pad operates in GPIO mode as a general purpose I/O.<br>11: INT1 pad operates as a test output.<br>**Important**: When INT1 is configured as a test output for digital test mux 1 (DMUX1), it must be configured in active-drive/push-pull mode. Set register 0x27 bits [3:2] to '11' to enable active-drive mode. |
| 3:2 | INT2_PAD_CFG[1:0] | INT2 pad configuration control. | 00: INT2 pad operates in interrupt request mode as an output (default).<br>01: Reserved.<br>10: INT2 pad operates in GPIO mode as a general purpose I/O.<br>11: INT2 pad operates as a test output.<br>**Important**: When INT2 is configured as a test output for digital test mux 2 (DMUX2), it must be configured in active-drive/push-pull mode. Set register 0x27 bits [7:6] to '11' to enable active-drive mode. |
| 4 | COMB_INTR_EN | Combine all interrupts to the selected INT pad. | 0: INT1 and INT2 interrupt sources are not combined (default).<br>1: INT1 and INT2 interrupt sources are combined.<br>By default, interrupts routed to the INT1 pad are the XL interrupt on sample, self-test interrupt and motion interrupts; interrupts routed to the INT2 pad are any of the FIFO interrupts (0x23 [3:0] = '0000' or 0x23 [7:4] = '0000').<br>When this bit is set to '1' and 0x23 [3:0] = '0000' or 0x23 [7:4] = '0000', all enabled interrupt sources are combined and sent to INT1 or INT2. |
| 7:5 | RESV | Reserved | Reserved. |

**Table 6-27: Register 0x26 bit assignments**



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### 6.1.28 0X27 – GPIO CONTROL REGISTER

| Addr | Name | Description | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| 0x27 | GPIO_CTRL | GPIO Control Register | GPIO2_ INT2_IPP | GPIO2_ INT2_IAH | GPIO2_ OUT_IN_N | GPIO2_ DATA | GPIO1_ INT1_IPP | GPIO1_ INT1_IAH | GPIO1_ OUT_IN_N | GPIO1_ DATA | 0x00 | R/W |

This register is used to select the INT1 pad and INT2 pad polarity and drive mode when the pads are used as interrupt request outputs, or GPIO outputs.

To use the GPIO functionality for the INT1 pad or the INT2 pad, the INT1_PAD_CFG[1:0] or INT2_PAD_CFG[1:0] control bits in register 0x26 must be set to '10'. The options in this register require GPIO mode to be enabled for the corresponding pad.

| Bit | Name | Function | Description |
|---|---|---|---|
| 0 | GPIO1_DATA | GPIO1 input (read) or output path (write) | Read path, configured as an input (bit 1 = 0)<br>0: INT1 pad input is at 0.<br>1: INT1 pad input is at 1.<br><br>Write path, configured as an output (bit 1 = 1)<br>0: INT1 pad is driven to a logic 0.<br>1: INT1 pad is driven to a logic 1.<br><br>In a read cycle, this bit is used to read the state of the INT1 pad. If the pad is configured as an input, then it returns the current level as read from the pad. If the pad is configured as an output, then this bit is the drive level applied to the pad.<br><br>In a write cycle, this bit is used to set the state of the pad. If the pad is configured as an output, then this bit determines the drive level applied to the pad. |
| 1 | GPIO1_OUT_IN_N | Set the direction of INT1 pad (input or output) | 0: INT1 pad is configured as an input (default).<br>1: INT1 pad is configured as an output. |
| 2 | GPIO1_INT1_IAH | Set polarity of INT1 output. | 0: The INT1 pad is active low.<br>1: The INT1 pad is active high.<br><br>This bit sets the polarity level of the INT1 pad. This bit is used in interrupt mode to set the level of the interrupt request, or in GPIO mode to set the level of the GPIO output drive. |
| 3 | GPIO1_INT1_IPP | Select open drain or push/pull mode for INT1. | 0: The INT1 pad operates in open-drain mode as an output.<br>1: The INT1 pad operates in push-pull mode as an output.<br><br>This bit sets the drive mode of the INT1 pad as an interrupt request output, or a GPIO output. |
| 4 | GPIO2_DATA | INT2 input (read) or output path (write) | Read path, configured as an input (bit 1 = 0)<br>0: INT2 pad input is at 0.<br>1: INT2 pad input is at 1. |



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| | | | |
|---|---|---|---|
| | | | Write path, configured as an output (bit 1 = 1)<br>0: INT2 pad is driven to a logic 0.<br>1: INT2 pad is driven to a logic 1.<br><br>In a read cycle, this bit is used to read the state of the INT2 pad. If the pad is configured as an input, then it returns the current level as read from the pad. If the pad is configured as an output, then this bit is the drive level applied to the pad.<br><br>In a write cycle, this bit is used to set the state of the pad. If the pad is configured as an output, then this bit determines the drive level applied to the pad. |
| **5** | GPIO2_OUT_IN_N | Set the direction of INT2 pad (input or output) | 0: INT2 pad is configured as an input (default).<br>1: INT2 pad is configured as an output. |
| **6** | GPIO2_INT2_IAH | Set polarity of INT2 output. | 0: The INT2 pad is active low.<br>1: The INT2 pad is active high.<br><br>This bit sets the polarity level of the INT2 pad. This bit is used in interrupt mode to set the level of the interrupt request, or in GPIO mode to set the level of the GPIO output drive. |
| **7** | GPIO2_INT2_IPP | Select open drain or push/pull mode for INT2. | 0: The INT2 pad operates in open-drain mode as an output.<br>1: The INT2 pad operates in push-pull mode as an output.<br><br>This bit sets the drive mode of the INT2 pad as an interrupt request output, or a GPIO output. |

**Table 6-28: Register 0x27 bit assignments**



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## 6.1.29 0X28 – I3C PARAMETER REGISTER 1

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| 0x28 | I3C_PARAM_1 I3C Parameter Register 1 | I3C_RESET | IBI_STATUS_SEL[2] | IBI_STATUS_SEL[2] | IBI_STATUS_SEL[0] | IBI_TRIG | RESV | IBI_INTR_REQ_SEL | IBI_EN_INTR | 0x00 | R/W |

| Bit | Name | Function | Description |
|---|---|---|---|
| 0 | IBI_EN_INTR | In-band interrupt enable (I3C only) | 0: Interrupts generated from Aries motion, sample or FIFO interrupt sources **do not** generate an in-band interrupt (default).<br>1: Interrupts generated from Aries motion, sample or FIFO interrupt sources **do** generate an in-band interrupt. This requires the corresponding interrupt enable bits be enabled in registers Pg0 0x20, 0x21 (sample, motion), or Pg0 0x30/0x31 (FIFO). |
| 1 | IBI_INTR_REQ_SEL | In-band interrupt request select (I3C only) | 0: Source for triggering an IBI is interrupt request 1 (INT1_REQ).<br>1: Source for triggering an IBI is interrupt request 1 (INT2_REQ). |
| 2 | RESV | Reserved | Reserved |
| 3 | IBI_TRIG | In-band interrupt manual trigger (I3C only) | 0: Do not manually trigger an IBI event (default).<br>1: Trigger a manual IBI event by writing to this bit.<br>This debug bit is intended for generating IBI events via a SW command. This will force Atria to place an IBI request on the I3C bus and wait for master arbitration. |
| 6:4 | IBI_STATUS_SEL[2:0] | In-band interrupt status byte select (I3C only) | These three select bits determine the payload of the IBI status byte that is sent to the I3C master. The following selections are available:<br>0: dev_status_1_i[7:0] – send the contents of register 0x03.<br>1: intr_status_1_i[7:0] – send the contents of register 0x10.<br>2: intr_status_2_i[7:0] – send the contents of register 0x11.<br>3: fifo_status_i[7:0] – send the contents of registers 0x18[2:1], 0x17[5:0].<br>4: status_reg_1_i[7:0] – send the contents of register 0x12.<br>5: Not used .<br>6: Not used.<br>7: Not used. |
| 7 | I3C_RESET | Local I2C/I3C core reset | 0: I3C core is not in reset (default).<br>1: Apply a reset to the I3C core only (positive edge).<br>This bit applies a local reset to the I2C/I3C core only. This bit will only reset the I3C core and no other parts of Atria. The contents of the registers, pipeline, FIFO, and OTP are not affected.<br>Setting this bit generates a 0->1 transition to the I3C core. |

**Table 6-29: Register 0x28 bit assignments**



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### 6.1.30 0X29 – I3C PARAMETER REGISTER 2

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| 0x29 | I3C_PARAM_2 I3C Parameter Register 2 | I3C_DYNA_ADDR[7] | I3C_DYNA_ADDR[6] | I3C_DYNA_ADDR[5] | I3C_DYNA_ADDR[4] | I3C_DYNA_ADDR[3] | I3C_DYNA_ADDR[2] | I3C_DYNA_ADDR[1] | I3C_DYNA_ADDR[0] | 0x00 | RO |

| Bit | Name | Function | Description |
|---|---|---|---|
| 7:0 | I3C_DYNA_ADDR[7:0] | Dynamically assigned I3C slave address. | This read only register returns the currently assigned I3C slave address. This is **not** the I2C slave address.<br>0x00: default unassigned address<br>0xXX: Master assigned I3C slave address (varies). |

**Table 6-30: Register 0x29 bit assignments**

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### 6.1.31 0X2A – I3C PARAMETER REGISTER 3

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| **0x2A** | **I3C Parameter Register 3** | **I3C_ENABLE** | I3C_STATUS_BYTE_SEL[2] | I3C_STATUS_BYTE_SEL[1] | I3C_STATUS_BYTE_SEL[0] | SPI_3WIRE_EN | **RESV** | I3C_PP_MAN_CTRL | I3C_PP_EN | 0x80 | R/W |

| Bit | Name | Function | Description |
|---|---|---|---|
| **0** | I3C_IPP_EN | I3C push-pull control | 0: Active drive/push-pull mode for SDA is disabled. (default)<br>1: Active drive/push-pull mode for SDA is enabled.<br>This bit controls the active drive mode for the SDA pad. This bit is only used when the I3C_PP_MAN_CTRL bit 1 (below) is set to '1'. |
| **1** | I3C_PP_MAN_CTRL | Enable manual control of the SDA pad | 0: Manual control of SDA drive mode is disabled (default)<br>1: Manual control of SDA drive mode is enabled.<br>Under typical usage, the I3C core controls the drive mode of the SDA pad. |
| **2** | **RESV** | Reserved | Reserved |
| **3** | SPI_3WIRE_EN | Enable 3-wire mode for SPI. | 0: SPI interface runs in 4-wire mode (default).<br>1: SPI interface runs in 3-wire mode.<br>In 3-wire mode, SPI read and write data use the SDA pad in bi-directional mode. In 4-wire mode, the SDA pad is used for input data only (MOSI), and the SDO is used for output data (MISO). |
| **6:4** | I3C_STATUS_BYTE_SEL[2:0] | Select the payload for the status byte when a GETSTATUS CCC command code is sent by the I3C master. | These three select bits determine the payload of the I3C status byte that is sent to the I3C master on a GETSTATUS command code. The following selections are available:<br>0: dev_status_1_i[7:0] – send the contents of register 0x03.<br>1: intr_status_1_i[7:0] – send the contents of register 0x10.<br>2: intr_status_2_i[7:0] – send the contents of register 0x11.<br>3: fifo_status_i[7:0] – send the contents of registers 0x18[2:1], 0x17[5:0].<br>4: status_reg_1_i[7:0] – send the contents of register 0x12.<br>5: Not used .<br>6: Not used.<br>7: Not used. |
| **7** | **I3C_ENABLE** | Enable i3c mode | 0: Disable i3c mode.<br>1: Enable i3c mode. (default) |

**Table 6-31: Register 0x2A bit assignments**



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### 6.1.32 0X2B,0X2C – ANYMOTION MOTION DELTA THRESHOLD

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| 0x2B | MOTION_ DELTA_ THRESH_0 | ANYMO_DELTA[7:0] | | | | | | | | 0x00 | R/W |
| 0x2C | MOTION_ DELTA_ THRESH_1 | RESV | ANYMO_DELTA[14:8] | | | | | | | 0x00 | R/W |

| Bit | Name | Function | Description |
|---|---|---|---|
| 0x2B [7:0] 0x2C[14:8] | ANYMO_DELTA [14:0] | AnyMotion Delta Threshold | This unsigned delta count is the delta to detect motion activity. |
| 0x2C [15] | RESV | Reserved | Reserved |

**Table 6-32: Register 0x2B, 0x2C bit assignments**



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### 6.1.33 0X2D – ANYMOTION DURATION THRESHOLD

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| **0x2D** | **MOTION_ DUR Motion Duration** | ANYMO_DUR[7:0] | | | | | | | | 0x00 | R/W |

| Bit | Name | Function | Description |
|---|---|---|---|
| **0x2D [7:0]** | ANYMO_DUR [7:0] | AnyMotion Duration Threshold | This unsigned value sets the minimum duration period (in samples) for a valid AnyMotion detection condition. |

**Table 6-33: Register 0x2D bit assignments**

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### 6.1.34 0X2E – ANYMOTION CONTROL REGISTER 0

| Addr | Name | Description | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| 0x2E | MOTION_ CTRL_0 | Motion Control Register 1 | RESV | RESV | NO_MO_ ENABLE_Z | NO_MO_ ENABLE_Y | NO_MO_ ENABLE_X | ANYM_ ENABLE_Z | ANYM_ ENABLE_Y | ANYM_ ENABLE_X | 0x00 | R/W |

| Bit | Name | Function | Description |
|---|---|---|---|
| 0 | ANYM_ ENABLE_X | Enable/Disable AnyMotion activity detection on the X-axis. | 0: Feature is disabled (default).<br>1: Feature is enabled. |
| 1 | ANYM_ ENABLE_Y | Enable/Disable AnyMotion activity detection on the Y-axis. | 0: Feature is disabled (default).<br>1: Feature is enabled. |
| 2 | ANYM_ ENABLE_Z | Enable/Disable AnyMotion activity detection on the Z-axis. | 0: Feature is disabled (default).<br>1: Feature is enabled. |
| 3 | NO_MO_ ENABLE_X | Enable/Disable NoMotion inactivity detection on the X-axis. | 0: Feature is disabled (default).<br>1: Feature is enabled. |
| 4 | NO_MO_ ENABLE_Y | Enable/Disable NoMotion inactivity detection on the y-axis. | 0: Feature is disabled (default).<br>1: Feature is enabled. |
| 5 | NO_MO_ ENABLE_Z | Enable/Disable NoMotion inactivity detection on the Z-axis. | 0: Feature is disabled (default).<br>1: Feature is enabled. |
| 6 | RESV | Reserved | Reserved |
| 7 | RESV | Reserved | Reserved |

**Table 6-34: Register 0x2E bit assignments**



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### 6.1.35 0X2F – MOTION CONTROL REGISTER 1

| Addr | Name | Description | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| **0x2F** | **MOTION_ CTRL_2** | Motion Control Register 2 | **RESV** | TF_ ENABLE | SIXD_EN | **RESV** | SHAKE_EN | **RESV** | FREEFALL_ EN | TAP_EN | 0x00 | R/W |

| Bit | Name | Description |
|---|---|---|
| **0** | TAP_DTAP_EN | 0: TAP/DTAP/TTAP detection is disabled (default).<br>1: TAP/DTAP/TTAP detection is enabled. |
| **1** | FREEFALL_EN | 0: FREEFALL_EN detection is disabled (default).<br>1: FREEFALL_EN detection is enabled. |
| **2** | **RESV** | Reserved. |
| **3** | SHAKE_EN | 0: Shake detection is disabled (default).<br>1: Shake detection is enabled. |
| **4** | **RESV** | Reserved. |
| **5** | SIXD_EN | 0: SIXD (6D) detection is disabled (default).<br>1: SIXD (6D) detection is enabled. |
| **6** | TF_ENABLE | 0: Tilt/Flip detection is disabled (default).<br>1: Tilt/Flip detection is enabled. |
| **7** | **RESV** | Reserved. |

**Table 6-35: Register 0x2F bit assignments**



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### 6.1.36 0X30 – MOTION CONTROL REGISTER 2

| Addr | Name | Description | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| **0x30** | **MOTION_ CTRL_2** | Motion Control Register 2 | MOTION_ RESET | **RESV** | **RESV** | **RESV** | **RESV** | RAW_ PROC_STAT | Z_AXIS_ORT | MOTION_ LATCH | 0x00 | R/W |

| Bit | Name | Description |
|---|---|---|
| **0** | MOTION_LATCH | 0: Motion block does not latch outputs (default)<br>1: Motion block latches outputs |
| **1** | Z_AXIS_ORT | 0: Z-axis orientation is positive through top of package. (default)<br>1: Z-axis orientation is positive through bottom of package.<br><br>The Z-axis orientation tells the logic which way the packaged device is mounted. A value of '0' is used for a bottom mount, and '1' is used for a top mount (affects filt/flip detection).<br><br>Note, this bit does not affect the polarity setting of the Z-axis, only with respect to the motion detection algorithms. |
| **2** | RAW_ PROC_STAT | 0: Motion flag bits are filtered by debounce and other settings (default)<br>1: Motion flag bits provide real-time, raw motion information, useful for debug. |
| **5:3** | **RESV** | Reserved |
| **6** | **RESV** | Reserved |
| **7** | MOTION_ RESET | 0: Motion block is not in reset (default)<br>1: The motion block is held in reset. SW must clear this bit for the reset to be released. This bit is not self-clearing. |

**Table 6-36: Register 0x30 bit assignments**



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### 6.1.37 0X31,0X32 – TILT/FLIP THRESHOLD REGISTER

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| **0x31** | **Tilt/Flip Threshold Register LSB** | TF_THR[7] | TF_THR[6] | TF_THR[5] | TF_THR[4] | TF_THR[3] | TF_THR[2] | TF_THR[1] | TF_THR[0] | 0x00 | R/W |
| **0x32** | **Tilt/Flip Threshold Register MSB** | **RESV** | TF_THR[14] | TF_THR[13] | TF_THR[12] | TF_THR[11] | TF_THR[10] | TF_THR[9] | TF_THR[8] | 0x00 | R/W |

| Bit | Name | Description |
|---|---|---|
| **0x31[7:0]**<br>**0x32[14:8]** | TF_THR[14:0] | This value is used for both the Flat/Tilt/Flip algorithms<br><br>TF_THR[14:0] is a 15-bit threshold value (unsigned) to detect Flat/Tilt/Flip position of the device. If the sample value is greater than the programmed value of this register, then a Tilt condition is detected. If the sample value is less than the programmed value of this register, then a Flat/Flip condition is detected depending on:<br>• The sample value of the Z-axis.<br>• The orientation of the chip is mounted on the platform which is determined by the Z-axis-orient bit at register 0x30 bit 1. |

**Table 6-37: Registers 0x31,0x32 bit assignments**



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### 6.1.38 0X33 – TILT/FLIP DEBOUNCE REGISTER

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| 0x33 | Tilt/Flip Debounce Register | TF_DB[7:0] | | | | | | | | 0x00 | R/W |

| Bit | Name | Description |
|---|---|---|
| 7:0 | TF_DB[7:0] | Programmed debounce value to detect the Tilt/Flip condition and set the corresponding interrupt.<br><br>Once a Tilt/Flip condition is detected for the duration programmed in this register, the Tilt/Flip interrupt is set. The debounce count is in terms of consecutive samples, which increment at the selected output data rate (ODR). |

**Table 6-38: Register 0x33 bit assignments**

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### 6.1.39 0X34,0X35 – NOMOTION THRESHOLD REGISTER

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| **0x34** | **NoMotion Threshold Register LSB** | NOMO_ THR[7] | NOMO_ THR[6] | NOMO_ THR[5] | NOMO_ THR[4] | NOMO_ THR[3] | NOMO_ THR[2] | NOMO_ THR[1] | NOMO_ THR[0] | 0x00 | R/W |
| **0x35** | **NoMotion Threshold Register MSB** | **RESV** | NOMO_ THR[14] | NOMO_ THR[13] | NOMO_ THR[12] | NOMO_ THR[11] | NOMO_ THR[10] | NOMO_ THR[9] | NOMO_ THR[8] | 0x00 | R/W |

| Bit | Name | Description |
|---|---|---|
| **0x34[7:0] 0x35[14:8]** | NOMO_THR[14:0] | This register holds the programmed 15-bit threshold value to detect No_Motion. If the delta of the current sample value and the previous sample value is less than the programmed value of this register, then NoMotion condition is detected. |

**Table 6-39: Register 0x34,0x35 bit assignments**



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### 6.1.40 0X36 – NOMOTION DEBOUNCE REGISTER

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| 0x36 | NoMotion Debounce Register | NOMO_DB[7:0] | | | | | | | | 0x00 | R/W |

Once a No_Motion condition is detected, the No_Motion interrupt is set in the interrupt register. This register holds the programmed debounce value to clear the No_Motion interrupt set in the interrupt register.

For the duration programmed in this register, if the No_Motion condition is not detected, then the No_Motion interrupt is cleared in the interrupt register. The debounce count is in terms of consecutive samples, which increment at the selected output data rate (ODR).

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### 6.1.41 0X37,0X38 – SHAKE THRESHOLD REGISTER

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| 0x37 | Shake Threshold Register LSB | SH_THR[7:0] | | | | | | | | 0x00 | R/W |
| 0x38 | Shake Threshold Register MSB | SH_THR[15:8] | | | | | | | | 0x00 | R/W |

This register holds the programmed 15-bit threshold value to detect Shake. If, the delta of the current sample value and the previous sample value, is greater than +/- programmed value of this register, then Shake condition is detected.

The threshold value is in terms of digital gain stage of the pipeline, prior to any range g-scale. For a 1.4fF/g sensitivity MEMS, this corresponds to a signed 15-bit, +/-24g reference frame of digital offset and gain corrected data.



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### 6.1.42 0X39,0X3A – SHAKE PEAK 2 PEAK DURATION THRESHOLD REGISTER

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| 0x39 | Peak P2P Duration Threshold LSB | PK_P2P_DUR[7] | PK_P2P_DUR[6] | PK_P2P_DUR[5] | PK_P2P_DUR[4] | PK_P2P_DUR[3] | PK_P2P_DUR[2] | PK_P2P_DUR[1] | PK_P2P_DUR[0] | 0x00 | R/W |
| 0x3A | Peak P2P Duration Threshold MSB | RESV | SHK_CNT_DUR[2] | SHK_CNT_DUR[1] | SHK_CNT_DUR[0] | PK_P2P_DUR[11] | PK_P2P_DUR[10] | PK_P2P_DUR[9] | PK_P2P_DUR[8] | 0x00 | R/W |

#### 6.1.42.1 **PEAK AND PEAK_TO_PEAK DURATION**

This registers 0x39 and 0x3A[3:0] holds the programmed value to detect the Peak and the Peak to Peak width of the Shake.

If the sample value is beyond (+/-) the shake threshold, then a Peak is detected and its width is measured as defined in this register. If the sample value is within (+/-) the shake threshold, then a Peak to Peak is detected and its width is measured as defined in this register. The duration count is in terms of consecutive samples, which increment at the selected output data rate (ODR).

#### 6.1.42.2 **SHAKE COUNTER**

This register i.e. 0x3B[6:4] holds the programmed value of the number of shake cycles to be detect. Once the programmed number of shake cycles are detected, the Shake interrupt is set in the interrupt status register. The shake count is in terms of consecutive samples, which increment at the selected output data rate (ODR).



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### 6.1.43 0X3B,0X3C – TAP EVENT THRESHOLD REGISTER

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| **0x3B** | TAP/DTAP/TTAP Event Threshold LSB Register | TAP_EVT_TH[7] | TAP_EVT_TH[6] | TAP_EVT_TH[5] | TAP_EVT_TH[4] | TAP_EVT_TH[3] | TAP_EVT_TH[2] | TAP_EV_TH[1] | TAP_EVT_TH[0] | 0x00 | R/W |
| **0x3C** | TAP/DTAP/TTAP Event Threshold MSB Register | **RESV** | TAP_EVT_TH[14] | TAP_EVT_TH[13] | TAP_EVT_TH[12] | TAP_EVT_TH[11] | TAP_EVT_TH[10] | TAP_EVT_TH[9] | TAP_EVT_TH[8] | 0x00 | R/W |

This unsigned threshold value applies to all tap events (single, double, and triple tap). The threshold value is in term of the selected XL g-range.

| Bit | Name | Function | Description |
|---|---|---|---|
| **0x3B 7:0**<br>**0x3C 6:0** | TAP_EVT_TH[14:0] | Tap Threshold Register | Specifies the threshold above which a tap event is detected. The value is a magnitude and is unsigned. |

**Table 6-40: Register 0x2A,0x2B bit assignments**



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### 6.1.44 0X3D – TAP SHOCK DURATION REGISTER

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| **0x3D** | TAP/DTAP/TTAP Shock Duration Register | TAP_SHOCK_DUR[7] | TAP_SHOCK_DUR[6] | TAP_SHOCK_DUR[5] | TAP_SHOCK_DUR[4] | TAP_SHOCK_DUR[3] | TAP_SHOCK_DUR[2] | TAP_SHOCK_DUR[1] | TAP_SHOCK_DUR[0] | 0x00 | R/W |

| Bit | Name | Function | Description |
|---|---|---|---|
| **7:0** | TAP_SHOCK_DUR[7:0] | Shock Duration Count for TAP/DTAP/TTAP | Specifies the shock duration in which the acceleration value should come below the tap event detection value . If the acceleration value does not fall below the event detection threshold in this period, then the event is not detected. The count is in terms of ODR/sample periods. |

**Table 6-41: Register 0x3D bit assignments**

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### 6.1.45 0X3E – TAP QUIET DURATION REGISTER

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| **0x3E** | TAP/DTAP/TTAP Quiet Duration Register | TAP_QUIET_DUR[7] | TAP_QUIET_DUR[6] | TAP_QUIET_DUR[5] | TAP_QUIET_DUR[4] | TAP_QUIET_DUR[3] | TAP_QUIET_DUR[2] | TAP_QUIET_DUR[1] | TAP_QUIET_DUR[0] | 0x00 | R/W |

| Bit | Name | Function | Description |
|---|---|---|---|
| **7:0** | TAP_ QUIET _DUR[7:0] | TAP/DTAP/TTAP Quiet Duration Register | After the shock period there should be no acceleration event above the detection threshold in Quiet Period. If there is an event above the threshold in Quiet Duration, then the tap event is not detected . This value is in terms of ODR or sample periods. |

**Table 6-42: Register 0x3E bit assignments**

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### 6.1.46 0X3F – TAP LATENCY DURATION REGISTER

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| **0x3F** | TAP Latency Duration Register LSB | TAP_LATENCY_DUR[7] | TAP_LATENCY_DUR[6] | TAP_LATENCY_DUR[5] | TAP_LATENCY_DUR[4] | TAP_LATENCY_DUR[3] | TAP_LATENCY_DUR[2] | TAP_LATENCY_DUR[1] | TAP_LATENCY_DUR[0] | 0x00 | R/W |

| Bit | Name | Function | Description |
|---|---|---|---|
| **7:0** | TAP_LATENCY_DUR[7:0] | Lower 8-bits of the Tap Latency Duration. The upper 5-bits are in register 0x2F. | Specifies the max delay between 2 successive tap events in generation of double tap and triple tap. This period starts after the quiet period is over the previous event. This value is in terms of ODR or sample periods. |

**Table 6-43: Register 0x3F bit assignments**

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### 6.1.47 0X40 – TAP CONTROL REGISTER

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| **0x40** | Tap Control/TAP Latency Duration Register MSB | MASK_Z | MASK_Y | MASK_X | TAP_ LATENCY_DUR[12] | TAP_ LATENCY_DUR[11] | TAP_ LATENCY_ DUR[10] | TAP_ LATENCY_ DUR[9] | TAP_ LATENCY_ DUR[8] | 0x00 | R/W |

| Bit | Name | Function | Description |
|---|---|---|---|
| **4:0** | TAP_LATENCY_DUR[12:8] | Upper 5-bits of the Tap Latency Duration. The lower 8-bits are in register 0x44 | Specifies the max delay between 2 successive tap events in generation of double tap and triple tap. This period starts after the quiet period is over the previous event. This value is in terms of ODR or sample periods. |
| **5** | MASK_X | Enable/Disable X-channel tap event detection | 0: X channel tap detection enabled (default)<br>1: X channel tap detection disabled |
| **6** | MASK_Y | Enable/Disable Y-channel tap event detection | 0: Y channel tap detection enabled (default)<br>1: Y channel tap detection disabled |
| **7** | MASK_Z | Enable/Disable Z-channel tap event detection | 0: Z channel tap detection enabled (default)<br>1: Z channel tap detection disabled |

**Table 6-44: Register 0x40 bit assignments**



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## 6.1.48 0X41,0X42 – FREEFALL THRESHOLD REGISTER

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| **0x41** | FreeFall Threshold LSB Register | FREEFALL_TH[7:0] | | | | | | | | 0x00 | R/W |
| **0x42** | FreeFall Threshold MSB Register | RESV | FREEFALL_TH[14:8] | | | | | | | 0x00 | R/W |

| Bit | Name | Function | Description |
|---|---|---|---|
| **0x41 7:0** | FREEFALL_TH[7:0] | Lower 8-bits of the Tap Latency Duration. The upper 7-bits are in register 0x31 | Specifies the threshold below which a freefall event is detected. All channel values need to be below this threshold for a freefall event to be detected. |
| **0x42 6:0** | FREEFALL_TH[14:8] | Upper 7-bits of the Tap Latency Duration. The lower 8-bits are in register 0x30. | |
| **0x42 7** | **RESV** | Reserved | Reserved |

**Table 6-45: Register 0x41,0x42 bit assignments**



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### 6.1.49 0X43 – FREEFALL DURATION REGISTER

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| 0x43 | FreeFall Duration Register | FREEFALL_DUR[7:0] | | | | | | | | 0x00 | R/W |

| Bit | Name | Function | Description |
|---|---|---|---|
| **7:0** | FREEFALL_ DUR [7:0] | FreeFall Duration Count | The acceleration values for all 3 channels need to be below the freefall threshold value for at least the free fall duration for the event to be considered as a valid freefall event. This value is in terms of ODR or sample periods. |

**Table 6-46: Register 0x43 bit assignments**

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### 6.1.50 0X44,0X45 – SIX DEGREES HIGH THRESHOLD REGISTER

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| **0x44** | SIXD High Threshold LSB Register | SIXD_HIGH_TH[7] | SIXD_HIGH_TH[6] | SIXD_HIGH_TH[5] | SIXD_HIGH_TH[4] | SIXD_HIGH_TH[3] | SIXD_HIGH_TH[2] | SIXD_HIGH_TH[1] | SIXD_HIGH_TH[0] | 0x00 | R/W |
| **0x45** | SIXD High Threshold MSB Register | **RESV** | SIXD_HIGH_TH[14] | SIXD_HIGH_TH[13] | SIXD_HIGH_TH[12] | SIXD_HIGH_TH[11] | SIXD_HIGH_TH[10] | SIXD_HIGH_TH[9] | SIXD_HIGH_TH[8] | 0x00 | R/W |

| Bit | Name | Function | Description |
|---|---|---|---|
| **0x44[7:0]** | SIXD_HIGH_TH [7:0] | Lower 8 bits of SIXD High Threshold LSB Register | Specifies the threshold above which an orientation event is detected. Two channels should have acceleration below the low threshold (SIXD_LOW_THRESH) and 1 channel should have acceleration above the threshold (SIXD_HIGH_THRESH) for the duration period (SIXD_DUR ) to register an orientation change. |
| **0x45 [6:0]** | SIXD_HIGH_TH [14:8] | Upper 7 bits of SIXD High Threshold MSB Register | |
| **0x45 [7]** | **RESV** | Reserved | Reserved |

**Table 6-47: Register 0x44,0x45 bit assignments**



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### 6.1.51 0X46,0X47 – SIX DEGREES LOW THRESHOLD REGISTER

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| **0x46** | SIXD Low Threshold LSB Register | SIXD_LOW_TH[7] | SIXD_LOW_TH[6] | SIXD_LOW_TH[5] | SIXD_LOW_TH[4] | SIXD_LOW_TH[3] | SIXD_LOW_TH[2] | SIXD_LOW_TH[1] | SIXD_LOW_TH[0] | 0x00 | R/W |
| **0x47** | SIXD Low Threshold MSB Register | **RESV** | SIXD_LOW_TH[14] | SIXD_LOW_TH[13] | SIXD_LOW_TH[12] | SIXD_LOW_TH[11] | SIXD_LOW_TH[10] | SIXD_LOW_TH[9] | SIXD_LOW_TH[8] | 0x00 | R/W |

| Bit | Name | Function | Description |
|---|---|---|---|
| **0x46 [7:0]** | SIXD_LOW_TH [7:0] | Lower 8 bits of SIXD Low Threshold LSB Register | Specifies the threshold below which an orientation event is detected. Two channels should have acceleration below the low threshold (SIXD_LOW_THRESH) and 1 channel should have acceleration above the threshold (SIXD_HIGH_THRESH) for the duration period (SIXD_DUR) to register an orientation change. |
| **0x47[6:0]** | SIXD_ LOW _TH [14:8] | Upper 7 bits of SIXD Low Threshold MSB Register | |
| **0x47 [7]** | **RESV** | Reserved | Reserved |

**Table 6-48: Register 0x46,0x47 bit assignments**



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### 6.1.52 0X48 – SIX DEGREE DURATION REGISTER

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| **0x48** | SIXD Duration Register | SIXD_DUR[7:0] | | | | | | | | 0x00 | R/W |

| Bit | Name | Function | Description |
|---|---|---|---|
| **0x37 [7:0]** | SIXD_DUR [7:0] | 8-bit duration value for SIXD evaluation | Two channels should have acceleration below the low threshold (SIXD_LOW_THRESH) and 1 channel should have acceleration above the threshold (SIXD_HIGH_THRESH) for the duration period (SIXD_DUR) to register an orientation change. This duration count is in terms of ODR or sample periods. |

**Table 6-49: Register 0x48 bit assignments**

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### 6.1.53 0X49 – SIX DEGREES STATUS REGISTER

This read-only register reports the status of the SIXD orientation logic. Only one of the six bits below will be set to '1' at any time.

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| **0x49** | SIXD Status Register | **RESV** | **RESV** | Z_NEG | Y_NEG | Z_NEG | Z_POS | Y_POS | X_POS | 0x01 | RO |

Note that Motion register default values are set under XL power domain. It needs to enable XL_PWR_EN(Refer to register 0x02 bit0) and to disable hold/isolation cells(Refer to register 0x02 bit3) to get motion register default values.

| Bit | Name | Function | Description |
|---|---|---|---|
| **0** | X_POS | X-axis positive | 0: System is not in X_POS orientation<br>1 : System is in X_POS orientation |
| **1** | Y_POS | Y-axis positive | 0: System is not in Y_POS orientation<br>1 : System is in Y_POS orientation |
| **2** | Z_POS | Z-axis positive | 0: System is not in Z_POS orientation<br>1 : System is in Z_POS orientation |
| **3** | X_NEG | X-axis negative | 0: System is not in X_NEG orientation<br>1 : System is in X_NEG orientation |
| **4** | Y_NEG | Y-axis negative | 0: System is not in Y_NEG orientation<br>1 : System is in Y_NEG orientation |
| **5** | Z_NEG | Z-axis negative | 0: System is not in Z_NEG orientation<br>1 : System is in Z_NEG orientation |
| **6** | **RESV** | Reserved | Reserved |
| **7** | **RESV** | Reserved | Reserved |

**Table 6-50: Register 0x49 bit assignments**



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### 6.1.54 0X4A – PIPELINE STATUS REGISTER

This read-only register reports the status of the XL pipeline.

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| **0x4A** | **PIPELINE** Pileline Status Register | **RESV** | | | | XL_CTRL_ TIMEOUT | PIPE_TIME OUT | PIPE_ STATE[1:0] | | 0x00 | RO |

| Bit | Name | Function | Description |
|---|---|---|---|
| **1:0** | PIPE_STATE[1:0] | XL pipeline status. | 0x0: PIPE_IDLE<br>0x1: PIPE_XY<br>0x2: PIPE_Z<br>0x3: Not used<br><br>Status bits to report the activity of the XL pipeline. |
| **2** | PIPE_TIMEOUT | XL pipeline timeout status. | 0: XL pipeline has not timed-out (default).<br>1: XL pipeline has timed out.<br><br>The DIS_PIPE_TIMOUT control bit is in register 0x56 bit 0. The default pipeline timeout is 30 clock cycles. This is a debug bit. |
| **3** | XL_CTRL_TIMEOUT | XL Control FSM timeout status. | 0: XL CTRL FSM has not timed-out (default).<br>1: XL CTRL FSM has timed-out.<br><br>The XL_CTRL_TIMEOUT_EN control bit is in register 0x56 bit 2. |
| **7:4** | **RESV** | Reserved. | Reserved, returns ‘0’ when read. |

**Table 6-51: Register 0x4A bit assignments**



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## 6.1.55 0X4E-0X55 – XY AXIS LPF COEFFICIENTS

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| **0x4E** | XL LPF Coefficient B0/B2 LSB | XY_LPF_B0[7] | XY_LPF_B0[6] | XY_LPF_B0[5] | XY_LPF_B0[4] | XY_LPF_B0[3] | XY_LPF_B0[2] | XY_LPF_B0[1] | XY_LPF_B0[0] | 0x00 | R/W |
| **0x4F** | XL LPF Coefficient B0 MSB | XY_LPF_B0[15] | XY_LPF_B0[14] | XY_LPF_B0[13] | XY_LPF_B0[12] | XY_LPF_B0[11] | XY_LPF_B0[10] | XY_LPF_B0[9] | XY_LPF_B0[8] | 0x00 | R/W |
| **0x50** | XL LPF Coefficient B1 LSB | XY_LPF_B1[7] | XY_LPF_B1[6] | XY_LPF_B1[5] | XY_LPF_B1[4] | XY_LPF_B1[3] | XY_LPF_B1[2] | XY_LPF_B1[1] | XY_LPF_B1[0] | 0x00 | R/W |
| **0x51** | XL LPF Coefficient B1 MSB | XY_LPF_B1[15] | XY_LPF_B1[14] | XY_LPF_B1[13] | XY_LPF_B1[12] | XY_LPF_B1[11] | XY_LPF_B1[10] | XY_LPF_B1[9] | XY_LPF_B1[8] | 0x00 | R/W |
| **0x52** | XL LPF Coefficient A1 LSB | XY_LPF_A1[7] | XY_LPF_A1[6] | XY_LPF_A1[5] | XY_LPF_A1[4] | XY_LPF_A1[3] | XY_LPF_A1[2] | XY_LPF_A1[1] | XY_LPF_A1[0] | 0x00 | R/W |
| **0x53** | XL LPF Coefficient A1 MSB | XY_LPF_A1[15] | XY_LPF_A1[14] | XY_LPF_A1[13] | XY_LPF_A1[12] | XY_LPF_A1[11] | XY_LPF_A1[10] | XY_LPF_A1[9] | XY_LPF_A1[8] | 0x00 | R/W |
| **0x54** | XL LPF Coefficient A2 LSB | XY_LPF_A2[7] | XY_LPF_A2[6] | XY_LPF_A2[5] | XY_LPF_A2[4] | XY_LPF_A2[3] | XY_LPF_A2[2] | XY_LPF_A2[1] | XY_LPF_A2[0] | 0x00 | R/W |
| **0x55** | XL LPF Coefficient A2 MSB | XY_LPF_A2[15] | XY_LPF_A2[14] | XY_LPF_A2[13] | XY_LPF_A2[12] | XY_LPF_A2[11] | XY_LPF_A2[10] | XY_LPF_A2[9] | XY_LPF_A2[8] | 0x00 | R/W |

| Bit | Name | Function | Description |
|---|---|---|---|
| **0x4E 7:0**<br>**0x4F 7:0** | XY LPF Coefficient B0/B2 LSB/MSB | 16-bit value for LPF coefficient B0 (unsigned) | This coefficient may be changed to match different ODR/sample rates and BW requirements. |
| **0x50 7:0**<br>**0x51 7:0** | XY LPF Coefficient B1 LSB/MSB | 16-bit value for LPF coefficient B1 (unsigned) | This coefficient may be changed to match different ODR/sample rates and BW requirements. |
| **0x52 7:0**<br>**0x53 7:0** | XY LPF Coefficient A1 LSB/MSB | 16-bit value for LPF coefficient A1 (unsigned) | This coefficient may be changed to match different ODR/sample rates and BW requirements. *This value is always considered a negative coefficient by the filter hardware.* |
| **0x54 7:0**<br>**0x55 7:0** | XY LPF Coefficient A2 LSB/MSB | 16-bit value for LPF coefficient A2 (unsigned) | This coefficient may be changed to match different ODR/sample rates and BW requirements. |

**Table 6-52: Registers 0x4E-0x55 bit assignments**



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## 6.1.56 0X56 – PIPELINE CONTROL REGISTER

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| **0x56** | **PIPE_CTRL** PIPELINE Control Register | **RESV** | | | | SDM_CLK_INV | XL_CTRL TIMEOU_EN | DIS_XL_AUTO_RESET | DIS_PIPE_TIMEOUT | 0x04 | RW |

| Bit | Name | Function | Description |
|---|---|---|---|
| **0** | DIS_PIPELINE_TIMEOUT | Disable pipeline timeout. | 0: Pipeline timeout flag operates as normal (default).<br>1: Pipeline timeout flag is disabled.<br><br>Note the pipeline timeout state flag is in register 0x4A bit 2. |
| **1** | DIS_XL_AUTO_RESET | Disable XL auto reset. | 0: XL domain (wake domain) reset is applied (default).<br>1: XL domain (wake domain) reset is disabled.<br><br>This bit is used to suppress the XL domain (wake domain) reset generated by the XL control logic when performing power management. |
| **2** | XL_CTRL_TIMEOUT_EN | Enable XL CTRL timeout. | 0: XL_CTRL state machine timeout is disabled (default).<br>1: XL_CTRL state machine timeout is enabled.<br><br>This feature prevents the XL_CTRL state machine from getting stuck in the SAMPLE_START state in WAKE mode.<br><br>When the LPF reset is applied, there is a chance the XL pipeline will not send a “done” strobe to the XL_CTRL FSM and it will become non-responsive.<br><br>Normally the SLEEP or STANDBY modes are required to recover, but the timeout feature will prevent this behavior in WAKE mode.<br><br>Register 0x4A bit 3 reports if a timeout condition is detected. |
| **3** | SDM_CLK_INV | Invert the polarity of the clock used to Analog SDM. | 0: Normal Analog SDM clk polarity (default).<br>1: Inverted Analog SDM clk polarity.<br><br>This bit is intended to provide an option for Analog SDM/ADC. This bit changes the edge from positive (default) to negative. The clock applied to the Analog SDM is inverted. |
| **7:4** | **RESV** | Reserved. | Reserved, returns ‘0’ when read. |

**Table 6-53: Register 0x56 bit assignments**



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### 6.1.57 0X58 - 0X5D – XL OFFSET_0 REGISTERS

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| **0x58** | **XL_XOFF_0** | X_XOFF_0[7] | X_XOFF_0[6] | X_XOFF_0[5] | X_XOFF_0[4] | X_XOFF_0[3] | X_XOFF_0[2] | X_XOFF_0[1] | X_XOFF_0[0] | OTP | R/W |
| **0x59** | **XL_XOFF_0** | X_XOFF_0[15] | X_XOFF_0[14] | X_XOFF_0[13] | X_XOFF_0[12] | X_XOFF_0[11] | X_XOFF_0[10] | X_XOFF_0[9] | X_XOFF_0[8] | OTP | R/W |
| **0x5A** | **XL_YOFF_0** | X_YOFF_0[7] | X_YOFF_0[6] | X_YOFF_0[5] | X_YOFF_0[4] | X_YOFF_0[3] | X_YOFF_0[2] | X_YOFF_0[1] | X_YOFF_0[0] | OTP | R/W |
| **0x5B** | **XL_YOFF_0** | X_XOFF_0[15] | X_YOFF_0[14] | X_YOFF_0[13] | X_YOFF_0[12] | X_YOFF_0[11] | X_YOFF_0[10] | X_YOFF_0[9] | X_YOFF_0[8] | OTP | R/W |
| **0x5C** | **XL_ZOFF_0** | X_ZOFF_0[7] | X_ZOFF_0[6] | X_ZOFF_0[5] | X_ZOFF_0[4] | X_ZOFF_0[3] | X_ZOFF_0[2] | X_ZOFF_0[1] | X_ZOFF_0[0] | OTP | R/W |
| **0x5D** | **XL_ZOFF_0** | X_XOFF_0[15] | X_ZOFF_0[14] | X_ZOFF_0[13] | X_ZOFF_0[12] | X_ZOFF_0[11] | X_ZOFF_0[10] | X_ZOFF_0[9] | X_ZOFF_0[8] | OTP | R/W |

Note, these offset settings are applied when register 0x20 bit 4 = ‘0’.

| Bit | Name | Function | Description |
|---|---|---|---|
| **0x58 7:0**<br>**0x59 7:0** | XL X-axis Offset LSB/MSB | X-axis, pipeline digital offset adjustment | This is a signed 2’s complement 16-bit value applied as an offset adjustment to the corresponding XL channel. Digital offset can range from 0x8000 (-32K) to 0x7FFF (+32K). |
| **0x5A 7:0**<br>**0x5B 7:0** | XL Y-axis Offset LSB/MSB | Y-axis, pipeline digital offset adjustment | This is a signed 2’s complement 16-bit value applied as an offset adjustment to the corresponding XL channel. Digital offset can range from 0x8000 (-32K) to 0x7FFF (+32K). |
| **0x5C 7:0**<br>**0x5D 7:0** | XL Z-axis Offset LSB/MSB | Z-axis, pipeline digital offset adjustment | This is a signed 2’s complement 16-bit value applied as an offset adjustment to the corresponding XL channel. Digital offset can range from 0x8000 (-32K) to 0x7FFF (+32K). |

**Table 6-54: Register 0x58-0x5D bit assignments**



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### 6.1.58 0X5E - 0X61,0X6C,0X79 – XL OFFSET_1 REGISTERS

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| **0x5E** | **XL_XOFF_1** | X_XOFF_1[7] | X_XOFF_1[6] | X_XOFF_1[5] | X_XOFF_1[4] | X_XOFF_1[3] | X_XOFF_1[2] | X_XOFF_1[1] | X_XOFF_1[0] | OTP | R/W |
| **0x5F** | **XL_XOFF_1** | X_XOFF_1[15] | X_XOFF_1[14] | X_XOFF_1[13] | X_XOFF_1[12] | X_XOFF_1[11] | X_XOFF_1[10] | X_XOFF_1[9] | X_XOFF_1[8] | OTP | R/W |
| **0x60** | **XL_YOFF_1** | X_YOFF_1[7] | X_YOFF_1[6] | X_YOFF_1[5] | X_YOFF_1[4] | X_YOFF_1[3] | X_YOFF_1[2] | X_YOFF_1[1] | X_YOFF_1[0] | OTP | R/W |
| **0x61** | **XL_YOFF_1** | X_XOFF_1[15] | X_YOFF_1[14] | X_YOFF_1[13] | X_YOFF_1[12] | X_YOFF_1[11] | X_YOFF_1[10] | X_YOFF_1[9] | X_YOFF_1[8] | OTP | R/W |
| **0x6C** | **XL_ZOFF_1** | X_ZOFF_1[7] | X_ZOFF_1[6] | X_ZOFF_1[5] | X_ZOFF_1[4] | X_ZOFF_1[3] | X_ZOFF_1[2] | X_ZOFF_1[1] | X_ZOFF_1[0] | OTP | R/W |
| **0x79** | **XL_ZOFF_1** | X_XOFF_1[15] | X_ZOFF_1[14] | X_ZOFF_1[13] | X_ZOFF_1[12] | X_ZOFF_1[11] | X_ZOFF_1[10] | X_ZOFF_1[9] | X_ZOFF_1[8] | OTP | R/W |

Note, these offset settings are applied when register 0x20 bit 4 = ‘1’.

| Bit | Name | Function | Description |
|---|---|---|---|
| **0x5E 7:0**<br>**0x5F 7:0** | XL X-axis Offset LSB/MSB | X-axis, pipeline digital offset adjustment | This is a signed 2’s complement 16-bit value applied as an offset adjustment to the corresponding XL channel. Digital offset can range from 0x8000 (-32K) to 0x7FFF (+32K). |
| **0x60 7:0**<br>**0x61 7:0** | XL Y-axis Offset LSB/MSB | Y-axis, pipeline digital offset adjustment | This is a signed 2’s complement 16-bit value applied as an offset adjustment to the corresponding XL channel. Digital offset can range from 0x8000 (-32K) to 0x7FFF (+32K). |
| **0x6C 7:0**<br>**0x79 7:0** | XL Z-axis Offset LSB/MSB | Z-axis, pipeline digital offset adjustment | This is a signed 2’s complement 16-bit value applied as an offset adjustment to the corresponding XL channel. Digital offset can range from 0x8000 (-32K) to 0x7FFF (+32K). |

**Table 6-55: Register 0x5E-0x61,0x6C,0x79 bit assignments**



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### 6.1.59 0X62 – XL POLARITY REGISTER

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| **0x62** | **XL Polarity Register** | I2C_ ADDR_1 | I2C_ ADDR_0 | **RESV** | **RESV** | **RESV** | XL_ Z_POL | XL_ Y_POL | XL_ X_POL | OTP | R/W |

The polarity control for each channel is at the end of the XL pipeline. When an axis is inverted, the output data is 2's complemented.

| Bit | Name | Function | Description |
|---|---|---|---|
| **0** | XL_X_POL | X-axis polarity | 0: X-axis data is not-inverted at end of pipeline (default)<br>1: X-axis data is not-inverted at end of pipeline. |
| **1** | XL_Y_POL | Y-axis polarity | 0: Y-axis data is not-inverted at end of pipeline (default)<br>1: Y-axis data is not-inverted at end of pipeline. |
| **2** | XL_Z_POL | Z-axis polarity | 0: Z-axis data is not-inverted at end of pipeline (default)<br>1: Z-axis data is not-inverted at end of pipeline. |
| **3** | **RESV** | Reserved | Reserved. |
| **4** | **RESV** | Reserved | Reserved. |
| **5** | **RESV** | Reserved | Reserved. |
| **6** | I2C_ADDR_0 | I2C slave address bit 0 | 0: Bit 0 of the 7-bit I2C slave address is 0 (default).<br>1: Bit 0 of the 7-bit I2C slave address is 1.<br><br>See Table 8 for available slave IDs. |
| **7** | I2C_ADDR_1 | I2C slave address bit 1 | 0: Bit 1 of the 7-bit I2C slave address is 0 (default).<br>1: Bit 1 of the 7-bit I2C slave address is 1.<br><br>See Table 8 for available slave IDs. |

**Table 6-56: Register 0x62 bit assignments**



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## 6.1.60 0X63-0X69 – XL AOFS OFFSET REGISTERS

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| 0x63 | **AOFS_XP** | AOFS_XP[7:0] | | | | | | | | OTP | R/W |
| 0x64 | **AOFS_XP** | AOFS_XN[7:0] | | | | | | | | OTP | R/W |
| 0x65 | **AOFS_YP** | AOFS_YP[7:0] | | | | | | | | OTP | R/W |
| 0x66 | **AOFS_YN** | AOFS_YN[7:0] | | | | | | | | OTP | R/W |
| 0x67 | **AOFS_ZP** | AOFS_ZP[7:0] | | | | | | | | OTP | R/W |
| 0x68 | **AOFS_ZN** | AOFS_ZN[7:0] | | | | | | | | OTP | R/W |
| 0x69 | **AOFS_MSB/ PREGAIN_MSB** | PRE_ DGAIN_Z[8] | PRE_ DGAIN_Y[8] | PRE_ DGAIN_X[8] | **RESV** | AOFSN_Y[8] | AOFSP_Y[8] | AOFSN_X[8] | AOFSP_X[8] | OTP | R/W |

| Bit | Name | Function | Description |
|---|---|---|---|
| **0x63 [7:0] 0x69 [0]** | AOFS_XP[8:0] | 9-bit analog offset adjustment value for XP side of X-axis MEMS input. | 9-bit unsigned value, 0x000 to 0x1FF (0 to 511). The total AOFS capacitance is:<br>**Caofs = 2 fF * (28 + aofs[8:0])** |
| **0x64 [7:0] 0x69 [1]** | AOFS_XN[8:0] | 9-bit analog offset adjustment value for XN side of X-axis MEMS input. | |
| **0x65 [7:0] 0x69 [2]** | AOFS_YP[8:0] | 9-bit analog offset adjustment value for YP side of Y-axis MEMS input. | |
| **0x66 [7:0] 0x69 [3]** | AOFS_YN[8:0] | 9-bit analog offset adjustment value for YN side of Y-axis MEMS input. | |
| **0x67 [7:0]** | AOFS_ZP[7:0] | 8-bit analog offset adjustment value for ZP side of Z-axis MEMS input. | |
| **0x68 [7:0]** | AOFS_ZN[7:0] | 8-bit analog offset adjustment value for ZN side of Z-axis MEMS input. | |

**Table 6-57: Register 0x63-0x69 bit assignments**



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### 6.1.61 0X6A,0X6B – XL ANALOG GAIN REGISTER 1 AND 2

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| **0x6A** | **XL Analog Gain Register 1** | ACL_AGAIN_Y[3:0] | | | | ACL_AGAIN_X[3:0] | | | | OTP | R/W |
| **0x6B** | **XL Analog Gain Register 2** | HYSTERESIS_HIGH | EN_IO_FILT_I3C_CTRL | EN_IO_FILT_VALUE | STICTION_EN | ACL_AGAIN_Z[3:0] | | | | OTP | R/W |

| Bit | Name | Function | Description |
|---|---|---|---|
| **3:0** | ACL_AGAIN_X[3:0] | Select the analog gain (AFG) for the X-axis. | 0x0: SDM FS = 5fF<br>0x1: SDM FS = 10fF<br>0x2: SDM FS = 15fF<br>0x3: SDM FS = 20 fF<br>0x4: SDM FS = 25 fF<br>0x5: SDM FS = 30 fF<br>0x6: SDM FS = 35 fF<br>0x7: SDM FS = 40 fF<br>0x8: SDM FS = 45 fF<br>0x9: SDM FS = 50 fF<br>0xA: SDM FS = 55 fF<br>0xB: SDM FS = 60 fF<br>0xC: SDM FS = 65 fF<br>0xD: SDM FS = 70 fF<br>0xE: SDM FS = 75 fF<br>0xF: SDM FS = 80 fF<br><br>gsel mode: SDM FS = 110 fF **(note special gsel mode)**<br><br>**Ctotal = 5 fF * (1 + ACL_AGAIN[3:0])** |
| **7:4** | ACL_AGAIN_Y[3:0] | Select the analog gain (AFG) for the Y-axis. | |

**Table 6-58: Register 0x6A bit assignments**



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| Bit | Name | Function | Description |
|---|---|---|---|
| **2:0** | ACL_AGAIN_Z[3:0] | Select the analog gain (AFG) for the Z-axis. | 0x0: SDM FS = 5fF<br>0x1: SDM FS = 10fF<br>0x2: SDM FS = 15fF<br>0x3: SDM FS = 20 fF<br>0x4: SDM FS = 25 fF<br>0x5: SDM FS = 30 fF<br>0x6: SDM FS = 35 fF<br>0x7: SDM FS = 40 fF<br>0x8: SDM FS = 45 fF<br>0x9: SDM FS = 50 fF<br>0xA: SDM FS = 55 fF<br>0xB: SDM FS = 60 fF<br>0xC: SDM FS = 65 fF<br>0xD: SDM FS = 70 fF<br>0xE: SDM FS = 75 fF<br>0xF: SDM FS = 80 fF<br><br>gsel mode: SDM FS = 110 fF **(note special gsel mode)**<br><br>**Ctotal = 5 fF * (1 + ACL_AGAIN[3:0])** |
| **4** | STICTION_EN | Enable the XL stiction detection/recovery feature. | 0: Stiction detection and recovery is not enabled (default).<br>1: Stiction detection and recovery is enabled.<br><br>This OTP bit allows the stiction detection/recovery feature to be disabled or enable for customer parts. |
| **5** | EN_IO_FILT_VALUE | Select state of IO filter when manual control is enabled. | 0: IO filter is disabled for SCL and SDA input paths.<br>1: IO filter is enabled for SCL and SDA input paths. |
| **6** | EN_IO_FILT_I3C_CTRL | Enable manual IO filter control. | 0: Manual control is disabled. (default).<br>1: Manual control is enabled. |
| **7** | HYSTERESIS_HIGH | Enable higher Vih level for digital inputs. | 0: High-level hysteresis is not enabled (default).<br>1: High-level hysteresis is enabled. |

**Table 6-59: Register 0x6B bit assignments**



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#### 6.1.61.1 RECOMMENDED AFG VS MEMS SENSITIVITY

| Sensitivity | Full Scale 24g | AFG (Analog Gain) |
|---|---|---|
| **<0.2fF/G** | <5fF | 0 (5fF) |
| **<0.4fF/G** | <10fF | 1 (10fF) |
| **<0.6fF/G** | <15fF | 2 (15fF) |
| **<0.8fF/G** | <20fF | 3 (20fF) |
| **<1.0fF/G** | <25fF | 4 (25fF) |
| **<1.25fF/G** | <30fF | 5 (30fF) |
| **<1.45fF/G** | <35fF | 6 (35fF) |
| **<1.65fF/G** | <20fF | 7 (40fF) |
| **<1.875fF/G** | <45fF | 8 (45fF) |
| **<2.0fF/G** | <50fF | 9 (50fF) |
| **<2.29fF/G** | <55fF | 10 (55fF) |
| **<2.5fF/G** | <60fF | 11 (60fF) |
| **<2.7fF/G** | <65fF | 12 (65fF) |
| **<2.9fF/G** | <70fF | 13 (70fF) |
| **<3.125fF/G** | <75fF | 14 (75fF) |
| **<3.33fF/G** | <80fF | 15 (80fF) |

**Table 6-60: MEMS sensitivity vs analog gain**

If the MEMS sensitivity is higher than 3.33fF/G, the full scale of the ASIC may not be sufficient to reach 16G full range.



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## 6.1.62 0X6D-0X72 – TCO COEFFICIENT REGISTERS

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| **0x6D** | **XL_X_TCO_A1 Coefficient** | GAIN_SHIFT_X[0] | XL_X_TCO_A1[6:0] | | | | | | | OTP | R/W |
| **0x6E** | **XL_X_TCO_A2 Coefficient** | GAIN_SHIFT_X[1] | XL_X_TCO_A2[6:0] | | | | | | | OTP | R/W |
| **0x6F** | **XL_Y_TCO_A1 Coefficient** | GAIN_SHIFT_X[2] | XL_Y_TCO_A1[6:0] | | | | | | | OTP | R/W |
| **0x70** | **XL_Y_TCO_A2 Coefficient** | GAIN_SHIFT_X[3] | XL_Y_TCO_A2[6:0] | | | | | | | OTP | R/W |
| **0x71** | **XL_Z_TCO_A1 Coefficient** | GAIN_SHIFT_X[4] | XL_Z_TCO_A1[6:0] | | | | | | | OTP | R/W |
| **0x72** | **XL_Z_TCO_A2 Coefficient** | GAIN_SHIFT_X[5] | XL_Z_TCO_A2[6:0] | | | | | | | OTP | R/W |

| Bit | Name | Function | Description |
|---|---|---|---|
| **6:0** | **XL_X_TCO_A1**<br>**XL_Y_TCO_A1**<br>**XL_Z_TCO_A1** | First order coefficient 'A1' for X, Y, and Z | Range: -64 to +63 (0x40 to 0x3F, 2's complement)<br>Fixed point scale is 2^3. |
| **6:0** | **XL_X_TCO_A2**<br>**XL_Y_TCO_A2**<br>**XL_Z_TCO_A2** | Second order coefficient 'A2' for X, Y, and Z | Range: -64 to +63 (0x40 to 0x3F, 2's complement)<br>Fixed point scale is 2^9. |

**Table 6-61: TCO coefficients**

| Atria2_TCO | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | a2 | | | | a1 | | | |
| | Suggest | Fixed point | Power index | bits | Suggest | Fixed point | Power index | bits |
| Max | 0.1365 | 0.125 | 2^-3 | 7 | 6.8266 | 8 | 2^3 | 7 |
| Min | -0.1365 | -0.125 | 2^-3 | | -6.8266 | -8 | 2^3 | |
| Step | 0.004265625 | 0.001953125 | 2^-9 | | 0.21333125 | 0.125 | 2^-3 | |

**Table 6-62: Format and range of TCO coefficients**



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The TCO correction applied to the XL output data is represented by the following:

$$\boldsymbol{data_{tco} = data + A2 * (T - T0)^2 + A1 * (T - T0)}$$

T0: Factory trim temperature stored in OTP.

T: Current temperature from the temperature sensor:

A1: Coefficient 'A' from the table above.

A2: Coefficient 'A' from the table above.

data: Output data from the corresponding X, Y, Z channel.

$data_{tco}$ : TCO corrected data from the corresponding X, Y, Z channel.

See section 6.1.63.2 for the fine sensitivity gain trim.

| Bits | Name | Function | Description |
|---|---|---|---|
| **0x6D[7]**<br>**0x6E[7]**<br>**0x6F[7]**<br>**0x70[7]**<br>**0x71[7]**<br>**0x72[7]** | **GAIN_SHIFT_X[5:0]** | Gain shift factor for X-channel. Used to compensate for changes in sensitivity when changing SDM sampling frequency. | Parameter range:<br><br>0x20: -32<br>0x00: 0 (default)<br>0x1F: +31 |

**Table 6-63: Format for X-axis gain shift**

| Step(fixed-pointed) | Step float | Parameter range | Trim range |
|---|---|---|---|
| 1/512 | 0.1953% | -32~31 (6 bits) | -6%~6% |

$$N_{output} = \left(input * \frac{40+PRE_{GAIN}}{128} + doffset + tco\right) * \left(1 + \frac{Gain_{shift}}{512}\right) * \left(1 + \frac{tcs}{8192}\right)$$

*Focus on:*

$$A = \left(1 + \frac{Gain_{shift}}{512}\right) * \left(1 + \frac{tcs}{8192}\right) = 1 + \frac{Gain_{shift}}{512} * \frac{tcs}{8192} + \frac{16Gain_{shift} + tcs}{8192}$$

$$\approx 1 + \frac{16Gain_{shift} + tcs}{8192}$$



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## 6.1.63 0X73-0X78 – TCS COEFFICIENT REGISTERS

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| **0x73** | **XL_X_TCS_A1 Coefficient** | GAIN_SHIFT_Y[1] | GAIN_SHIFT_Y[0] | XL_X_TCS_A1[5:0] | | | | | | OTP | R/W |
| **0x74** | **XL_X_TCS_A2 Coefficient** | GAIN_SHIFT_Y[3] | GAIN_SHIFT_Y[2] | XL_X_TCS_A2[5:0] | | | | | | OTP | R/W |
| **0x75** | **XL_Y_TCS_A1 Coefficient** | GAIN_SHIFT_Y[5] | GAIN_SHIFT_Y[4] | XL_Y_TCS_A1[5:0] | | | | | | OTP | R/W |
| **0x76** | **XL_Y_TCS_A2 Coefficient** | GAIN_SHIFT_Z[1] | GAIN_SHIFT_Z[0] | XL_Y_TCS_A2[5:0] | | | | | | OTP | R/W |
| **0x77** | **XL_Z_TCS_A1 Coefficient** | GAIN_SHIFT_Z[3] | GAIN_SHIFT_Z[2] | XL_Z_TCS_A1[5:0] | | | | | | OTP | R/W |
| **0x78** | **XL_Z_TCS_A2 Coefficient** | GAIN_SHIFT_Z[5] | GAIN_SHIFT_Z[4] | XL_Z_TCS_A2[5:0] | | | | | | OTP | R/W |

### 6.1.63.1 TCS COEFFICIENTS

| Bit | Name | Function | Description |
|---|---|---|---|
| **5:0** | **XL_X_TCS_A1**<br>**XL_Y_TCS_A1**<br>**XL_Z_TCS_A1** | First order coefficient 'A1' for X, Y, and Z | See table below. |
| **5:0** | **XL_X_TCS_A2**<br>**XL_Y_TCS_A2**<br>**XL_Z_TCS_A2** | Second order coefficient 'A2' for X, Y, and Z | See table below. |

**Table 6-64: TCS coefficients**

(1) Compensation formula: TCS = $a2(T-T_0)^2 + a1(T-T_0)$.
   a) Coefficients: secondary term coefficient a2, Primary term coefficient a1.
   b) Room temperature $T_0$, typical value is 25 degrees Celsius.
   c) Temperature variable T, typical range -40 to 85 degrees Celsius.

$$y_{sensitivity}(T) = y_{sensitivity}(T0)(1 + y_{TCS}(T))$$

$$y_{TCS}(T) = \mathbf{a_2} * (\mathbf{T} - \mathbf{T0})^{\mathbf{2}} + \mathbf{a_1} * (\mathbf{T} - \mathbf{T0}))$$

**where:**



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$y_{sensitivity}(T)$: **sensitivity deviation at temperature T**

$y_{sensitivity}(T0)$: **sensitivity deviation at temperature T0**

$y_{TCS}(T)$: **Temperature coefficient of Sensitivity(TCS), can be represented by a 2nd order polynomial**

| Atria2_TCS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | a2(the second order) | | | | a1(the first order) | | | |
| | Suggest | Fixed point | Power index | bits | Suggest | Fixed point | Power index | bits |
| Max | 0.000005 | 7.63E-06 | 2^-17 | 6 | 0.0005 | 4.88E-04 | 2^-11 | 6 |
| Min | -0.000005 | -7.63E-06 | 2^-17 | | -0.0005 | -4.88E-04 | 2^-11 | |
| Step | 3.125E-07 | 2.38E-07 | 2^-22 | | 3.13E-05 | 1.53E-05 | 2^-15 | |

**Table 6-65: Format and range of TCS coefficients**

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### 6.1.63.2 FINE SENSITIVITY GAIN TRIM

| Bits | Name | Function | Description |
|---|---|---|---|
| **0x73[7:6]**<br>**0x74[7:6]**<br>**0x75[7:6]** | **GAIN_SHIFT_Y[5:0]** | Gain shift factor for Y-channel. Used to compensate for changes in sensitivity when changing SDM sampling frequency. | Parameter range:<br><br>0x20: -32<br>0x00: 0 (default)<br>0x1F: +31 |
| **0x76[7:6]**<br>**0x77[7:6]**<br>**0x78[7:6]** | **GAIN_SHIFT_Z[5:0]** | Gain shift factor for Z-channel. Used to compensate for changes in sensitivity when changing SDM sampling frequency. | |

**Table 6-66: Y and z gain shift assignments**

| Step(fixed-pointed) | Step float | Parameter range | Trim range |
|---|---|---|---|
| 1/512 | 0.1953% | -32~31 (6 bits) | -6%~6% |

$$N_{output} = \left(input * \frac{40+PRE_{GAIN}}{128} + doffset + tco\right) * \left(1 + \frac{Gain_{shift}}{512}\right) * \left(1 + \frac{tcs}{8192}\right)$$

*Focus on:*

$$A = \left(1 + \frac{Gain_{shift}}{512}\right) * \left(1 + \frac{tcs}{8192}\right) = 1 + \frac{Gain_{shift}}{512} * \frac{tcs}{8192} + \frac{16Gain_{shift} + tcs}{8192}$$

$$\approx 1 + \frac{16Gain_{shift} + tcs}{8192}$$

**Trim Procedure**

(1)Set sys_clk to 1.6MHz, and set *offset_sel to 1, read out rbm_1g and rbm_-1g, and calculate gain_float1 and offset_float1;*

*(2) set **OTP_OFFSET1** to **round(offset_float1)**, set **OTP_PREGAIN** to **round(gain_float1*128-40)**;*

*(3) set sys_clk to 200KHz, and set offset_sel to 0, read out rbm_1g and rbm_-1g, and calculate gain_float2 and offset_float2;*

*(4) set **OTP_OFFSET0** to **round(offset_float2)**, set **OTP_GAINSHIFT** to **round((gain_float2/gain_float1-1)*512)**;*



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### 6.1.64 0X7A,0X7B,0X7C,0X7D – TEMPERATURE TRIM REGISTERS

| Addr | Name | Description | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| 0x7A | TEMP_DATA_T0_LSB | Factory Trim Temp T0 Data LSB | TEMP_DATA_T0[7:0] | | | | | | | | OTP | R/W |
| 0x7B | TEMP_DATA_T0_MSB | Factory Trim Temp T0 Data MSB | PCODE[0] | TEMP_COEFF[8] | TEMP_TRIM_T0[2:0] | | | TEMP_DATA_T0 [10:8] | | | OTP | R/W |
| 0x7C | TEMP_TRIM_T0 | Factory Trim Temp T0 | TEMP_TRIM_T0[10:3] | | | | | | | | OTP | R/W |
| 0x7D | TEMP_COEFF | Temperature Coefficient | TEMP_COEFF[7:0] | | | | | | | | OTP | R/W |

| Bit | Name(s) | Function | Description |
|---|---|---|---|
| **0x7A [7:0]**<br>**0x7B [2:0]** | TEMP_DATA_T0[10:0]<br>**code(T0)**<br>**or code_T0** | Output code (data) of the temperature sensor at the trim temperature of T0. | This 11-bit value is the output of temperature sense @ T0 at which the factory trim was performed.<br><br>Range: 800 - 1400 |
| **0x7B [5:3]**<br>**0x7C [7:0]** | TEMP_TRIM_T0[10:0]<br>**T0**<br>**or temp_T0** | Temperature at which factory trim was performed, T0. | This 11-bit value is the temperature T0 at which the factory trim was performed.<br><br>Range: 293 - 303 |
| **0x7B [7:0]**<br>**0x7B [6]** | TEMP_COEFF[8:0]<br>**GC1 or**<br>**gcoef** | Temperature scaling coefficient. | Temperature scaling coefficient.<br><br>Range: 200 - 500 |
| **0x7B [7]** | PCODE[0] | Optional product code. | Bit 0 of 3-bit PCODE, used for SW identification of specific Memsic product splits based on a common CMOS version. |

**Table 6-67: Registers 0x7A,0x7B,0x7C,0x7D bit assignments**

The temperature sensor output is reported in registers 0x0E and 0x0F. The output temperature is clamped between 223 and 398 kelvin. The corrected temperature is represented by

$$\boldsymbol{T} = \frac{\frac{\boldsymbol{code(T0)}}{\boldsymbol{code(T)}} - \boldsymbol{1}}{\boldsymbol{TC1}} + \boldsymbol{T0} = \boldsymbol{GC1} * \left( \frac{\boldsymbol{code(T0)}}{\boldsymbol{code(T)}} - \boldsymbol{1} \right) + \boldsymbol{T0}$$

$T0$: calibration temperature

$code(T0)$: temperature sensor output code (11-bit) at calibration temperature $T0$

$code(T)$: temperature sensor output code (11-bit) at temperature $T$



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$TC1$: linear fit coefficient

$GC1$: $GTC1=1/TC1$ (9-bit)

$T$: current temperature (11-bit)

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## 6.1.65 0X7E,0X7F,0X80 - PRE-DIGITAL GAIN REGISTERS

| Addr | Name | Description | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| **0x7E** | PRE_ DGAIN_X | X-axis Pre Digital Gain | PRE_GAIN_X[7:0] | | | | | | | | OTP | R/W |
| **0x7F** | PRE_ DGAIN_Y | Y-axis Pre Digital Gain | PRE_GAIN_Y[7:0] | | | | | | | | OTP | R/W |
| **0x80** | PRE_ DGAIN_Z | Z-axis Pre Digital Gain | PRE_GAIN_Z[7:0] | | | | | | | | OTP | R/W |
| **0x69** | PREGAIN_ MSB | XYZ Pre-Digital Gain MSB | PRE_ DGAIN_ Z[8] | PRE_ DGAIN_ Y[8] | PRE_ DGAIN_ X[8] | **RESV** | AOFSN_ Y[8] | AOFSP_ Y[8] | AOFSN_ X[8] | AOFSP _X[8] | OTP | R/W |

| Bit | Name | Function | Description |
|---|---|---|---|
| **0x69[5], 0x7E [7:0]** | PRE_GAIN_X[8:0] | Pre-digital gain for X-axis. | 9-bit unsigned pre (first) digital gain stage for XL.<br>Range = 0.3125 to 4.26875<br>Use a value of 44 to set the pre-gain to 1x.<br><br>PRE_DGAIN = (20 + PRE_GAIN_CODE) / 64 |
| **0x69[6], 0x7F [7:0]** | PRE_GAIN_Y[8:0] | Pre-digital gain for Y-axis. | |
| **0x69[7], 0x80 [7:0]** | PRE_GAIN_Z[8:0] | Pre-digital gain for Z-axis. | |

**Table 6-68: Registers 0x69,0x7E,0x7F,0x80 bit assignments**



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## 6.1.66 0X81,0X82 - SYS_OSC TRIM REGISTERS 1/2

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| **0x81** | **SYS_OSC Trim Register 1** | PCODE[1] | SYS_OSC_ FTRIM1[6] | SYS_OSC_ FTRIM1[5] | SYS_OSC_ FTRIM1[4] | SYS_OSC_ FTRIM1[3] | SYS_OSC_ FTRIM1[2] | SYS_OSC_ FTRIM1[1] | SYS_OSC_ FTRIM1[0] | OTP | R/W |
| **0x82** | **SYS_OSC Trim Register 2** | PCODE[2] | SYS_OSC_ FTRIM2[6] | SYS_OSC_ FTRIM2[5] | SYS_OSC_ FTRIM2[4] | SYS_OSC_ FTRIM2[3] | SYS_OSC_ FTRIM2[2] | SYS_OSC_ FTRIM2[1] | SYS_OSC_ FTRIM1[0] | OTP | R/W |

| Bit | Name | Function | Description |
|---|---|---|---|
| **0x81 [6:0]** | SYS_OSC_FTRIM1 | 7-bit trim for the SYS_OSC.<br>**Applies to 1.6 MHz mode.** | This value is OTP backed and reloaded on a POR or soft-reset. This value is unsigned.<br><br>When the SYS_OSC is in 1.6 MHz mode (0x20 [6] = '0') this trim value is used to adjust the SYS_OSC.<br><br>0x00: Lowest trim value (default).<br>0x40: Mid-range trim value<br>**0x50: Default value while POR or BOOT is in progress.**<br>0x7F: Highest trim value. |
| **0x81 [7]** | PCODE[1] | Optional product code. | Bit 1 of 3-bit PCODE, used for SW identification of specific Memsic product splits based on a common CMOS version. |

**Table 6-69: Register 0x81 bit assignments**

| Bit | Name | Function | Description |
|---|---|---|---|
| **0x82 [6:0]** | SYS_OSC_FTRIM2 | 7-bit trim for the SYS_OSC.<br>**Applies to 200 kHz mode.** | This value is OTP backed and reloaded on a POR or soft-reset. This value is unsigned.<br><br>When the SYS_OSC is in 200 kHz mode (0x20 [6] = '1') this trim value is used to adjust the SYS_OSC.<br><br>0x00: Lowest trim value (default).<br>0x40: Mid-range trim value<br>0x7F: Highest trim value. |
| **0x82 [7]** | PCODE[2] | Optional product code. | Bit 2 of 3-bit PCODE, used for SW identification of specific Memsic product splits based on a common CMOS version. |

**Table 6-70: Register 0x82 bit assignments**



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### 6.1.67 0X84 - 0X87 – DEVICE ID/PART ID REGISTERS

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| **0x84** | **Part ID Byte 1** | PID_1[7] | PID_1[6] | PID_1[5] | PID_1[4] | PID_1[3] | PID_1[2] | PID_1[1] | PID_1[0] | OTP | R/W |
| **0x85** | **Part ID Byte 2** | PID_2[7] | PID_2[6] | PID_2[5] | PID_2[4] | PID_2[3] | PID_2[2] | PID_2[1] | PID_2[0] | OTP | R/W |
| **0x86** | **Part ID Byte 3** | PID_3[7] | PID_3[6] | PID_3[5] | PID_3[4] | PID_3[3] | PID_3[2] | PID_3[1] | PID_3[0] | OTP | R/W |
| **0x87** | **Part ID Byte 4** | PID_4[7] | PID_4[6] | PID_4[5] | PID_4[4] | PID_4[3] | PID_4[2] | PID_4[1] | PID_4[0] | OTP | R/W |

The Atria2 part ID (serial number) is stored in these four dedicated OTP backed registers. The recommended format is:

| Addr | Name | Description |
|---|---|---|
| **0x84** | PID_1[7:0] | Device X-location on the wafer. |
| **0x85** | PID_2[7:0] | Device Y-location on the wafer. |
| **0x86** | PID_3[7:0] | Wafer ID. |
| **0x87** | PID_4[7:0] | Lot ID. |

**Table 6-71: Register 0x84-0x87 suggested assignments**



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## 6.1.68 0X88 - ANALOG CONTROL REGISTER 1

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| 0x88 | ANA_CTRL_1 Analog Control Register 1 | RESV | | | PM_IBIAS_PD_EN | PM_ALDO_PD_EN | PMU_IBIAS_PD | RESV | PMU_AVDD_PD | 0x00 | R/W |

| Bit | Name | Function | Description |
|---|---|---|---|
| 0 | PMU_AVDD_PD | Manual control for powering down analog and ALDO. | 0: Manual control of ALDO/AVDD power is disabled (default).<br>1: Force the ALDO/AVDD to power down.<br><br>The PMU_AVDD_PD control is affected by:<br>-0x88[0] state<br>-Automatic power control (if enabled)<br>-SLEEP Mode (ALDO is powered off) |
| 1 | RESV | Reserved. | Reserved.<br><br>Note, was connected to PMU_BG_LP. No longer connected in the analog block. |
| 2 | PMU_IBIAS_PD | Manual control for powering down the IBIAS/current in the analog. | 0: Manual control of IBIAS block power is disabled.<br>1: Force the IBIAS block to power down.<br><br>The PMU_IBIAS_PD control is affected by:<br>-0x88[2] state<br>-Automatic power control (if enabled)<br>-SLEEP Mode (IBIAS is powered off) |
| 3 | PM_ALDO_PD_EN | Allow the ALDO to be powered off when in duty cycling mode. | 0: The ALDO/AVDD is not powered off between duty-cycled samples (default).<br>1: The ALDO/AVDD is powered off between duty-cycled samples.<br><br>Note that register 0x05 bit 3 must be set to '1' for this mode to work. |
| 4 | PM_IBIAS_PD_EN | Allow the IBIAS/currents to be powered off when in duty cycling mode. | 0: The IBIAS block is not powered off between duty-cycled samples (default).<br>1: The IBIAS block is powered off between duty-cycled samples.<br><br>Note that register 0x05 bit 3 must be set to '1' for this mode to work. |
| 7:5 | RESV | Reserved. | Reserved.<br><br>Note, was PMU_ALDO_IB_N[2:0], no longer connected in the analog block. |

**Table 6-72: Register 0x88 bit assignments**



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### 6.1.69 0X8C – ANALOG CONTROL REGISTER 5

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| **0x8C** | **ANA_CTRL_5 Analog Control Register 5** | PMU_ALDO_STB_BOOST | PMU_DLDO_STB_BOOST | LP_MODE_OTA2_Z | LP_MODE_OTA1_Z | **RESV** | **RESV** | LP_MODE_OTA2_XY | LP_MODE_OTA1_XY | 0x00 | R/W |

| Bit | Name | Function | Description |
|---|---|---|---|
| **0** | LP_MODE_OTA1_XY | Additional control for OTA1 low power mode. | 0: Fs = 1.6 MHz (default).<br>1: Fs = 200 kHz. |
| **1** | LP_MODE_OTA2_XY | Additional control for OTA2 low power mode. | 0: Disabled (default)<br>1: Fs <= 1.6 MHz. |
| **3:2** | **RESV** | Reserved. | Reserved. |
| **4** | LP_MODE_OTA1_Z | Additional control for OTA1 low power mode. | 0: Fs = 1.6 MHz (default).<br>1: Fs = 200 kHz. |
| **5** | LP_MODE_OTA2_Z | Additional control for OTA2 low power mode. | 0: Disabled (default)<br>1: Fs <= 1.6 MHz. |
| **6** | PMU_DLDO_STB_BOOST | Boost DLDO regulator bias current in duty cycled, low power mode. | 0: Boost current is disabled (default).<br>1: Boost current is enabled<br><br>Enabling the 'boost' bits for the ALDO or DLDO will increase current but improve stability. |
| **7** | PMU_ALDO_STB_BOOST | Boost ALDO regulator bias current in duty cycled, low power mode. | |

**Table 6-73: Register 0x8C bit assignments**



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### 6.1.70 0X8D – ANALOG CONTROL REGISTER 6

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| 0x8D | ANA_CTRL_6 Analog Control Register 6 | RESV | RESV | INT2_ PE_EN | TEST_INT1_ PE_EN | SPI_ DOUT_ PE_EN | SPI_CS_ PE_EN | SDA_PE _EN | SCL_PE_ EN | 0x3F | R/W |

Each pad has a weak current pullup to keep undriven or disabled pads from floating or causing high current draw. Each bit defaults to a logic '1' or "enable pullup" following a POR or soft-reset.

| Bit | Name | Function | Description |
|---|---|---|---|
| 0 | SCL_PE_EN | SCL pad pullup-enable. | 0: Pad 50nA pullup is not enabled.<br>1: Pad 50nA pullup is enabled (default). |
| 1 | SDA_PE_EN | SDA pad pullup-enable. | 0: Pad 50nA pullup is not enabled.<br>1: Pad 50nA pullup is enabled (default). |
| 2 | SPI_CS_PE_EN | CS# pad pullup-enable. | 0: Pad 50nA pullup is not enabled.<br>1: Pad 50nA pullup is enabled (default). |
| 3 | SPI_DOUT_PE_EN (SDO_PE_EN) | SDO pad pullup-enable. | 0: Pad 50nA pullup is not enabled.<br>1: Pad 50nA pullup is enabled (default). |
| 4 | TEST_INT1_PE_EN | INT1 pad pullup-enable. | 0: Pad 50nA pullup is not enabled.<br>1: Pad 50nA pullup is enabled (default). |
| 5 | INT2_PE_EN | INT2 pad pullup-enable. | 0: Pad 50nA pullup is not enabled.<br>1: Pad 50nA pullup is enabled (default). |
| 6 | RESV | Reserved | Reserved. |
| 7 | RESV | Reserved | Reserved. |

**Table 6-74: Register 0x8D bit assignments**



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### 6.1.71 0X90 – Z-AXIS DECIMATION COUNT

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| **0x90** | XL_DEC_REG_Z XL Z Decimation Register | XL_Z_DEC_CNT_Z[7:0] | | | | | | | | 0x04 | R/W |

| Bit | Name | Description |
|---|---|---|
| **7:0** | XL_Z_DEC_COUNT[7:0] | Set the decimation count for the XL Z channel; does not apply to X or Y.<br>• The XL Z averaging filter must be enabled for the decimation count to apply (register 0x91 bit 1 = '1'), otherwise the count is set to 1.<br>• If the Z-channel SDM mode is set to "non-overlap, double Z mode" (register 0x91 [3:2] = '01') AND the Z-averaging filter is enabled (register 0x91 bit 1 = '1', the averaging filter decimation count is **divided by 2**.<br>0x00: Z decimation count is 256 (default).<br>0x01-0xFF, Z decimation count is 1 to 255.<br>See register 0x91 for additional Z-channel controls. Also see register 0x22, the XY-axis decimation count. |

**Table 6-75: register 0x90 bit assignments**



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## 6.1.72 0X91 – Z-AXIS CONTROL REGISTER

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| 0x91 | XL_DEC_REG_Z Z Decimation Register | RESV | XL_OSR_SEL_Z[2:0] | | | XL_SDM_MODE_Z[1:0] | | XL_WTD_AVG_FILTER_Z_EN | RESV | 0x10 | R/W |

| Bit | Name | Function | Description |
|---|---|---|---|
| 0 | RESV | Reserved. | Reserved. |
| 1 | XL_WTD_AVG_FILTER_Z_EN | Enable control, Z-axis WAF. | 0: Z-axis weighted average filter is disabled (default).<br>1: Z-axis weighted average filter enabled. |
| 3:2 | XL_SDM_MODE_Z[1:0] | Z-channel SDM sampling mode. | Select Z-axis sampling mode; also affects the shared X and Y sampling.<br><br>00 Z-axis only<br>01: Z-axis runs double<br>10: Z-axis overlap X and Y sampling<br>11: XY, Z are both switched |
| 6:4 | XL_OSR_SEL_Z[2:0] | Z-axis OSR select. | OSR[2:0] / Selected OSR / Notes<br>000 / 32 / Sinc filter output rate is Fs/32.<br>001 / 64 / Sinc filter output rate is Fs/64.<br>010 / 125 / Sinc filter output rate is Fs/128.<br>011 / 256 / Sinc filter output rate is Fs/256.<br>100 / 512 / Sinc filter output rate is Fs/512. |
| 7 | RESV | Reserved. | Reserved. |

**Table 6-76: Register 0x91 bit assignments**



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### 6.1.73 0X92 – SELF-TEST HOLD COUNT REGISTER

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| 0x92 | RESV | SLFTST_HOLD_CNT[7:0] | | | | | | | | 0x00 | R/W |

| Bit | Name | Function | Description |
|---|---|---|---|
| 7:0 | SLFTST_HOLD_CNT[7:0] | Self-test hold count parameter. | The self-test hold count is the number of system clock cycles the MEMS is held in tilt mode during the self-test operation.<br><br>The actual counter is a 17-bit value. The counter terminal count value is {slftst_hold_cnt[7:0], 000000000}.<br><br>For example, if the system clock frequency is 1.6 MHz, loading a value of 0x20 in register 0x92 will result in a ~10ms MEMS hold time.<br><br>{reg92[7:0],000000000} -> {0010_0000,000000000} -> 0x4000<br><br>0x4000 -> 16384 decimal<br><br>16384 x 625 ns = 10.240 ms MEMS hold time delay |

**Table 6-77: Register 0x92 bit assignments**



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## 6.1.74 0X94 – DIGITAL TEST REGISTER 2 (SELF-TEST COUNT)

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| **0x94** | **DTEST_REG_2 Digital Test Register 2 (Self-Test Count)** | **RESV** | INT1_EXT_CLK_SEL | SLFTST_CNT[5:0] | | | | | | 0x14 | R/W |

| Bit | Name | Function | Description |
|---|---|---|---|
| **5:0** | SLFTST_CNT[7:0] | Self-test count parameter. | This 6-bit unsigned value is the number of system/sample clocks to wait before capturing data into the sinc filter.<br><br>Once the tilt hold count has been reached (reg 0x92), the MEMS is released from the tilt position. The sinc filter will begin capturing data from the SDM/ADC after the count in register 0x94 has been reached.<br><br>Minimum value: 0x01<br>Default value: 0x14 (20 cycles)<br>Maximum value: 0x3F (63 cycles) |
| **6** | INT1_EXT_CLK_SEL | Enable external system clock injection via the INT1 pad. | 0: External clock injection is INT2 pad (default).<br>1: External clock injection is INT1 pad, and external clock enabled to replace SYS_OSC from analog.<br><br>Once this bit is 0, INT2 pad works as external clock injection. It still needs to assert Reg93 bit3 to enable external clock to replace SYS_OSC from analog. |
| **7** | RESV | Reserved. | Reserved. |

**Table 6-78: Register 0x94 bit assignments**



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### 6.1.75 0X95 – WARM-UP REGISTER (SDM POWER DELAY COUNT)

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| **0x95** | **Warm-up Register WARM_UP_REG** | SDM_PWR_DLY_CNT[7:0] | | | | | | | | 0x08 | R/W |

| Bit | Name | Function | Description |
|---|---|---|---|
| **7:0** | SDM_PWR_DLY_CNT[7:0] | Warm-up count for SDM, Self-test count parameter. | This 8-bit unsigned value is left shifted by 1 to form the SDM power delay count. This is the time between when the SDM/ADCs are powered up and when sampling begins.<br><br>In duty-cycled, low power modes the SDM/ADC may be optionally powered off between XYZ samples. This programmable count allows for the SDM/ADC and analog to bias and stabilize.<br><br>Any non-zero value programmed into this register will be multiplied by 2 to form the actual delay time. For example, if 0x03 is loaded into register 0x95, the SDM_PWR_DLY count will be 0x06 system/ sample clocks.<br><br>Note that any duty-cycled ODR must take this delay time into account.<br><br>Minimum value: 0x00 (default)<br>Maximum value: 0xFF (Yields 0x1FE or 510 counts).<br><br>Maximum delay time at 1.6 MHz is ~318 us |

**Table 6-79: Register 0x95 bit assignments**



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### 6.1.76 0X98 – SINC DUMMY COUNT REGISTER

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| **0x98** | **SINC Dummy Count Register**<br>**DUMMY_CNT_REG** | SINC_DUMMY2_CNT[3:0] | | | | SINC_DUMMY1_CNT[3:0] | | | | 0x00 | R/W |

| Bit | Name | Function | Description |
|---|---|---|---|
| **3:0** | SINC_DUMMY1_CNT[3:0] | Dummy or delay count for SINC filters. | Set the number of clock cycles for the DUMMY1 delay period times 4.<br><br>0x0 – Dummy1 count is 0<br>0x1 – Dummy1 count is 4<br>0x2 – Dummy1 count is 8<br>0x3 – Dummy1 count is 12<br>…<br>0xF – Dummy1 count is 60 (15 x 4). |
| **7:4** | SINC_DUMMY2_CNT[3:0] | Dummy or delay count for SINC filters. | Set the number of clock cycles for the DUMMY2 delay period times 4.<br><br>0x0 – Dummy2 count is 0<br>0x1 – Dummy2 count is 4<br>0x2 – Dummy2 count is 8<br>0x3 – Dummy2 count is 12<br>…<br>0xF – Dummy2 count is 60 (15 x 4). |

**Table 6-80: Register 0x98 bit assignments**

See register 0x9D for the SINC_STATE_XY and SINC_STATE_Z FSM states. The dummy counts control the DUMMY1 and DUMMY2 state delays.



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### 6.1.77 0X9C – XL SELF-TEST REGISTER 2

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| 0x9C | XL_SELF_TEST_2 | STICTION_POLARITY_SWAP | D_ZPST_IS_GND_O | SLFTST_TANDR_PM_HIGH | SLFTST_TANDR_N_HIGH | SLFTTST_MAN_EN | SLFTST_TANDR_Z_EN | SLFTST_TANDR_Y_EN | SLFTST_TANDR_X_EN | 0x00 | R/W |

| Bit | Name | Function | Description |
|---|---|---|---|
| 0 | SLFTST_TANDR_X_EN | MEMS self-test, tilt-and-release enable, X-axis. | 0: X-axis/MEMS self-test mode is not enabled (default).<br>1: X-axis/MEMS self-test mode is enabled.<br><br>Generally self-test is managed by the XL_CTRL state machine. Set register 0x04 bits 1:0 = '10' for self-test mode to be active.<br><br>If more than one channel is selected for self-test (bits 2:0), the X, Y, and then Z will be given priority. It is required to run self-test one channel at a time. The state machine supports single channel execution only. |
| 1 | SLFTST_TANDR_Y_EN | MEMS self-test, tilt-and-release enable, Y-axis. | 0: Y-axis/MEMS self-test mode is not enabled (default).<br>1: Y-axis/MEMS self-test mode is enabled.<br><br>Generally self-test is managed by the XL_CTRL state machine. Set register 0x04 bits 1:0 = '10' for self-test mode to be active. |
| 2 | SLFTST_TANDR_Z_EN | MEMS self-test, tilt-and-release enable, Z-axis. | 0: Z-axis/MEMS self-test mode is not enabled (default).<br>1: Z-axis/MEMS self-test mode is enabled.<br><br>Generally self-test is managed by the XL_CTRL state machine. Set register 0x04 bits 1:0 = '10' for self-test mode to be active. |
| 3 | SLFTTST_MAN_EN | Manual control of self-test feature. | 0: XL_CTRL state machine manages self-test mode (default).<br>1: XL_CTRL state machine does not manage self-test mode, bits 2:0 allow for direct selection of axis enable. |
| 4 | SLFTST_TANDR_N_HIGH | Select level of self-test. | 0: Self-test level is set to high (default).<br>1: Self-test level is set to low. |
| 5 | SLFTST_TANDR_PM_HIGH | Select level of PM drive during self-test. | 0: PM drive high is not enabled during self-test (default).<br>1: PM drive high is enabled during self-test. |
| 6 | D_ZPST_IS_GND_O | Set the level on the ZPST pin. | 0: ZPST_IS_GND is set to AVDD (default)<br>1: ZPST_IS_GND is set to GND (Like original Atria1). |
| 7 | STICTION_POLARITY_SWAP | Swap the polarity of the stiction detection level. | Set the polarity of the SLFTST_TANDR_N_HIGH assertion level.<br><br>0: SLFTST_TANDR_N_HIGH level = polarity of digital flag (default)<br>1: SLFTST_TANDR_N_HIGH level = ~polarity of digital flag |

**Table 6-81: Register 0x9C bit assignments**



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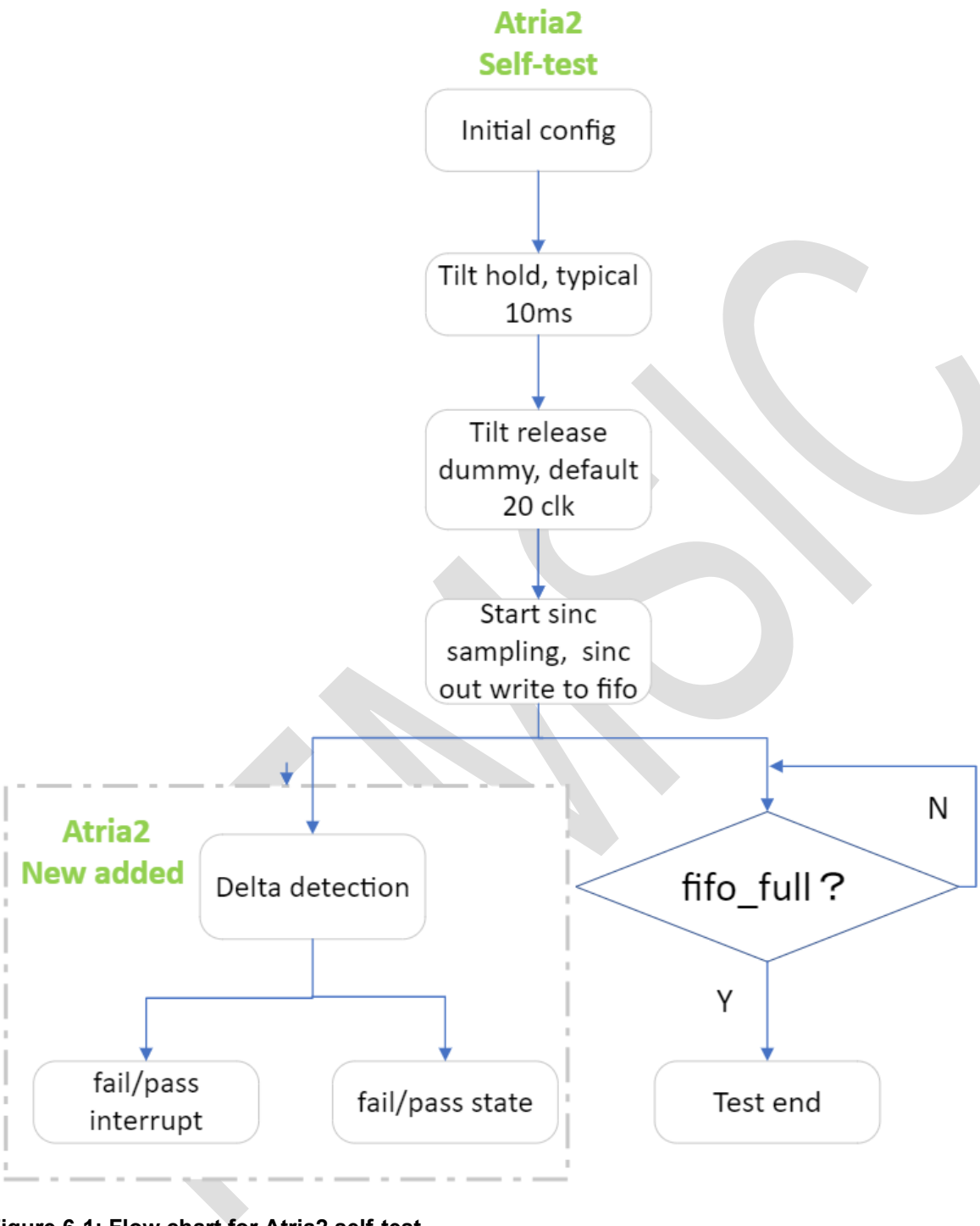



**Figure 6-1: Flow chart for Atria2 self-test**



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### 6.1.78 0X9D – XL SINC STATE FSM STATUS REGISTER

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| 0x9D | XL_SINC_STATE_FSM<br>XY and Z SINC FSM Status Register | MOTION_CURRENT_ST[1:0] | | SINC_STATE_Z[2:0] | | | SINC_STATE_XY[2:0] | | | 0x00 | RO |

This read-only register reports the current state of the XL SINC state machines, XY and Z.

| Bit | Name | Function | Description |
|---|---|---|---|
| **2:0** | SINC_STATE_XY[2:0] | XL control state machine. | SINC_IDLE = 4'd0,<br>SINC_DUMMY1 = 4'd1,<br>SINC_DUMMY2 = 4'd2,<br>SINC_X = 4'd3,<br>SINC_Y = 4'd4<br><br>Other states apply to Z axis only. |
| **5:3** | SINC_STATE_Z[2:0] | XL control state machine. | SINC_IDLE = 4'd0,<br>SINC_DUMMY1 = 4'd1,<br>SINC_DUMMY2 = 4'd2,<br>SINC_Z1 = 4'd3,<br>SINC_Z2 = 4'd4,<br>SINC_Z_DLY = 4'd5,<br>SINC_Z3 = 4'd6,<br>SINC_DUMMY3 = 4'd7; |
| **7:6** | MOTION_CURRENT_ST[1:0] | Motion interface state machine. | IDLE = 2'b00, // Motion FSM is idle<br>X_CH = 2'b01, // X sample sent to motion logic<br>Y_CH = 2'b10, // Y sample sent to motion logic<br>Z_CH = 2'b11 // Z sample sent to motion logic<br><br>Shows the status of the FSM that feeds X, Y, and Z sample data into the motion detection logic. |

**Table 6-82: Register 0x9D bit assignments**



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### 6.1.79 0XA0, 0XA1 – XY AXIS DCM TEST REGISTERS

| Addr | Name | Description | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| **0xA0** | **XL_DCM_XY_LSB** | XL Duty Cycle XY LSB | XL_DCM_XY[7:0] | | | | | | | | 0x00 | R/W |
| **0xA1** | **XL_DCM_XY_MSB** | XL Duty Cycle XY MSB | XL_DCM_XY[15:8] | | | | | | | | 0x00 | R/W |

#### 6.1.79.1 DCM/DUTY CYCLE GENERATORS

The duty cycle generator modules (DCM) output a 1-bit waveform that is very similar to the duty-cycle output of the actual AGC/SDM. When the DCM is enabled, the input to the sinc filter is switched from the external SDM/ADC to the internal DCM source.

#### 6.1.79.2 DUTY CYCLE PERCENTAGES

The percentage duty cycle a DCM can generate is related to the OSR selected. The table below shows sample duty cycle percentages for various OSRs. The higher the OSR, the more settings that are available between 0% and 100%. For example, at OSR32 there are 32 possible duty cycle percentages available, at OSR256, there are 256 values available. A 50% duty cycle is 0g.

Note that in Atria2, the highest OSR is 512.

| Percentage | OSR 32 Write value to DCM | OSR 64 Write value to DCM | OSR 128 Write value to DCM | OSR 256 Write value to DCM | OSR 512 Write value to DCM | OSR 1024 Write value to DCM | OSR 2048 Write value to DCM | OSR 4096 Write value to DCM | Expected XL RBM Output |
|---|---|---|---|---|---|---|---|---|---|
| 0% | 0x0000 | 0x0000 | 0x0000 | 0x0000 | 0x0000 | 0x0000 | 0x0000 | 0x0000 | 0xC000 |
| 25% | 0x008 | 0x0010 | 0x0020 | 0x0040 | 0x0080 | 0x0100 | 0x0200 | 0x0400 | 0xE000 |
| 50% | 0x0010 | 0x0020 | 0x0040 | 0x0080 | 0x0100 | 0x0200 | 0x0400 | 0x0800 | 0x0000 |
| 75% | 0x0018 | 0x0030 | 0x0060 | 0x00C0 | 0x0180 | 0x0300 | 0x0600 | 0x0C00 | 0x2000 |
| 100% | 0x0020 | 0x0040 | 0x0080 | 0x0100 | 0x0200 | 0x0400 | 0x0800 | 0x1000 | 0x3FFF |

**Table 6-83: DCM values with OSR**



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## 6.1.80 0XA2 – INTERRUPT AUTO CLEAR REGISTER

| Addr | Name | Description | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| **0xA2** | **INTR_AUTO_CLR** | Interrupt Auto Clear Register | **RESV** | AUTO_CLEAR_EN | MOTIONLESS_CFG[2:0] | | | AUTO_CLEAR_CFG[2:0] | | | 0x00 | R/W |

| Bit | Name | Function | Description |
|---|---|---|---|
| **2:0** | AUTO_CLEAR_CFG[2:0] | Maximum timing window for an ANY_MOTION interrupt to be serviced/cleared. If the ANY_MOTION interrupt is not cleared during this period, hardware will automatically clear the interrupt and the end of the timing window. | 0x0, 0x1: duration 320 ms (default)<br>0x2: duration 640 ms<br>0x3: duration 1280 ms<br>0x4: duration 2560 ms<br>0x5-0x7: duration 5120 ms<br><br>See register 0x11 bit 2 and register 0x24 bit 2 for the ANY_MOTION_INTR control.<br><br>See the following page for the 'auto-clear' sequence. |
| **5:3** | MOTIONLESS_CFG[2:0] | Timing window following an ANY_MOTION interrupt that is serviced and cleared by software. If no additional ANY_MOTION interrupts are triggered during the timing window, a new MOTIONLESS interrupt will be asserted by hardware. | 0x0, 0x1: duration 320 ms (default)<br>0x2: duration 640 ms<br>0x3: duration 1280 ms<br>0x4: duration 2560 ms<br>0x5-0x7: duration 5120 ms<br><br>See register 0x11 bit 6 and register 0x25 bit 6 for the MOTIONLESS_INTR control.<br><br>See the following page for the 'motionless' sequence. |
| **6** | AUTO_CLEAR_EN | Enable the auto clear feature for the ANY_MOTION interrupt. | 0: AUTO_CLEAR feature is disabled (default).<br>1: AUTO_CLEAR feature is enabled. |
| **7** | **RESV** | Reserved. | Reserved, returns '0' when read. |

**Table 6-84: Register 0xA2 bit assignments**



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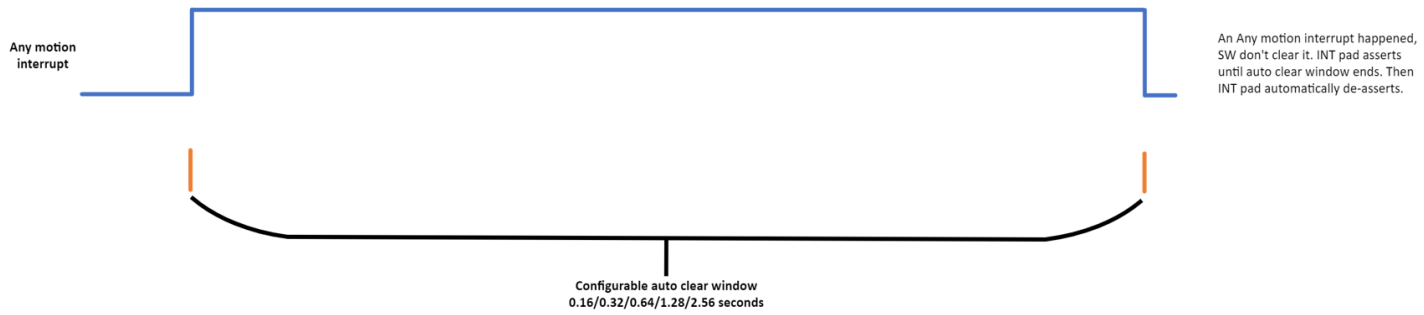



**Figure 6-2: AUTO_CLEAR with ANY_MOTION interrupt**

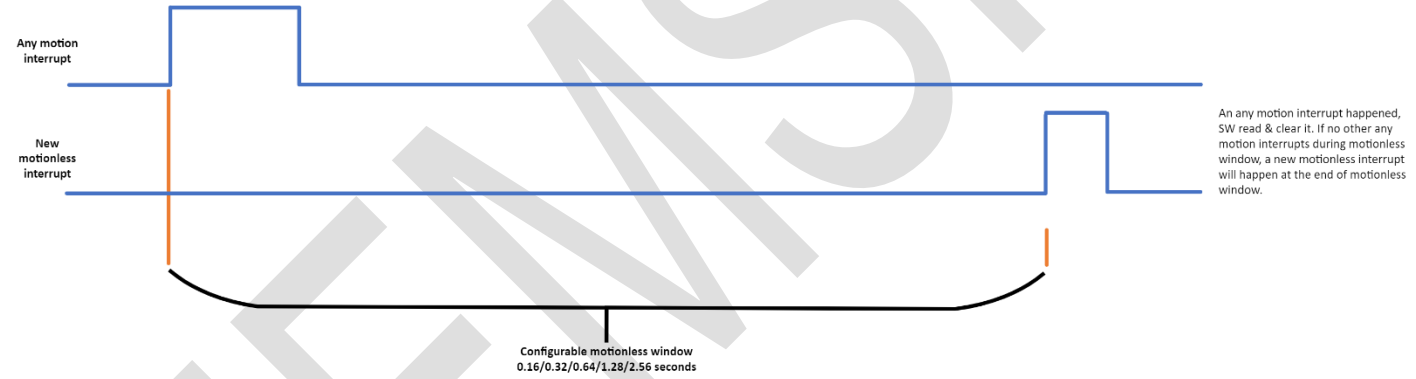



**Figure 6-3: MOTIONLESS with ANY_MOTION interrupt**



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### 6.1.81 0XA4,0XA5 –Z AXIS DCM TEST REGISTERS

| Addr | Name | Description | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| **0xA4** | **XL_DCM_Z_LSB** | XL Duty Cycle X LSB | XL_DCM_Z[7:0] | | | | | | | | 0x00 | R/W |
| **0xA5** | **XL_DCM_Z_MSB** | XL Duty Cycle X MSB | XL_DCM_Z[15:8] | | | | | | | | 0x00 | R/W |

See registers 0xA0, 0xA1 for a description of the DCM/duty cycle modulator features and usage.

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### 6.1.82 0XA9,0XAA – TEMPERATURE CALIBRATION OUTPUT REGISTERS

| Addr | Name | Description | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| 0xA9 | TEMP_CAL_OUT_LSB | Temp Debug Register | DUT_TEMP_OUT[7:0] | | | | | | | | 0x00 | RO |
| 0xAA | TEMP_CAL_OUT_MSB | Temp Debug Register | TCS_OUT[11:8] | | | | RESV | DUT_TEMP_OUT[10:8] | | | 0x00 | RO |

The output temperature is clamped between 223 and 398 kelvin. The dut_temp_out[10:0] is computed using the following formula in the temp_cal module in hardware

$$\boldsymbol{T} = \frac{\frac{\boldsymbol{code(T0)}}{\boldsymbol{code(T)}} - \boldsymbol{1}}{\boldsymbol{TC1}} + \boldsymbol{T0} = \boldsymbol{GC1} * \left( \frac{\boldsymbol{code(T0)}}{\boldsymbol{code(T)}} - \boldsymbol{1} \right) + \boldsymbol{T0}$$

$T0$: calibration temperature

$code(T0)$: temperature sensor output code (11-bit) at calibration temperature $T0$

$code(T)$: temperature sensor output code (11-bit) at temperature $T$

$TC1$: linear fit coefficient

$GC1$: $GTC1 = 1/TC1$ (9-bit)

$T$: current temperature (11-bit)

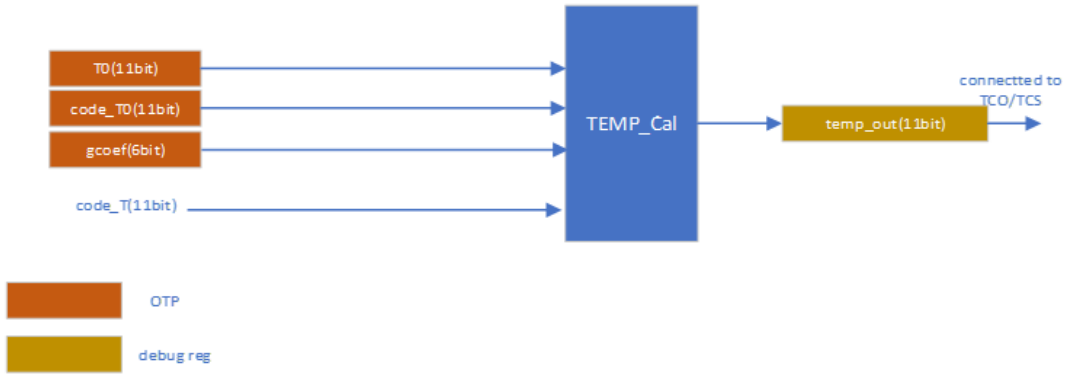
| Interface | Definition | Range | Width | Registers |
|---|---|---|---|---|
| **code_T0** | $code(T0)$, read from OTP | 800~1400 | 11-bits | {Reg7C[7:0], reg7B[5:3]} |
| **temp_T0** | $T0$, read from OTP | 293~303 | 11-bits | {Reg7B[2:0], reg7A[7:0]} |
| **gcoef** | $GC1$, read from OTP | 200-500 | 9-bits | {Reg7B[6], reg7D[7:0]} |

**Table 6-85: OTP based temperature trim values**



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$$T = GC1 * \left( \frac{\mathbf{code(T0)}}{\mathbf{code(T)}} - \mathbf{1} \right) + \mathbf{T0}$$




| Interface name | definition | range | width |
|---|---|---|---|
| **code_T0** | $code(T0)$, read from OTP | 800~1400 | input [10:0] |
| **temp_T0** | $T0$,read from OTP | 293~303 | input [10:0] |
| **gcoef** | $GC1/8$, read from OTP | 25~63 | input [5:0] |
| **din_data** | code(T), sensor output data | 0~1023 | input [10:0] |
| **din_busy** | handshake of input | 0/1 | output |
| **din_vld** | handshake of input | 0/1 | input |
| **dout_data** | $T$, output data | 223-398 | output [10:0] |
| **dout_busy** | handshake of output | 0/1 | Input |
| **dout_vld** | handshake of output | 0/1 | Output |

**Figure 6-4: Temperature calibration block details**



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### 6.1.83 0XAB,0XAC – SELF TEST THRESHOLD REGISTERS

| Addr | Name | Description | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| **0xAB** | **SLFTST_TH_LSB** | Self-Test Threshold LSB | SLFTST_TH[7:0] | | | | | | | | 0x00 | R/W |
| **0xAC** | **SLFTST_TH_LSB MSB** | Self-Test Threshold MSB | SLFTST_TH[15:8] | | | | | | | | 0x00 | RW |

| Bit | Name | Function | Description |
|---|---|---|---|
| **0xAB[7:0]**<br>**0xAC[8:0]** | SLFTST_TH[15:0] | Self-test threshold setting | The self-test threshold use an unsigned 16-bit delta count for determining the pass/fail status of the TANDR self-test.<br><br>As the self-test data is being read and captured to the FIFO, the maximum and minimum values from the SINC filter data are stored. Hardware will identify the maximum and minimum signed values.<br><br>After the self-test is completed, the delta value will be calculated by subtracting the max – min captured values. The delta count is compared with the self-test threshold to determine pass for fail.<br><br>**SLFTST_RESULT = DELTA > SLFTST_TH**<br><br>0x0000 – minimum self-test threshold<br>…..<br>0xFFFF – maximum self-test threshold<br><br>• Competition of the self-test is indicated by register 0x97 bit 7.<br><br>• Pass/fail status of the self-test is indicated by register 0x12 bit 0.<br><br>• The self-test interrupt status is located at register 0x10 bit 0. |

**Table 6-86: Registers 0xAB,0xAC bit assignments**

See sections Register 0x04 Self-test mode for more information.



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## 6.1.84 0XAD-0XB4 – Z AXIS LPF COEFFICIENTS

| Addr | Name | Bit | | | | | | | | POR Value | R/W |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | | |
| **0xAD** | Z LPF Coefficient B0 LSB | Z_LPF_B0[7] | Z_LPF_B0[6] | Z_LPF_B0[5] | Z_LPF_B0[4] | Z_LPF_B0[3] | Z_LPF_B0[2] | Z_LPF_B0[1] | Z_LPF_B0[0] | 0x00 | R/W |
| **0xAE** | Z LPF Coefficient B0 MSB | Z_LPF_B0[15] | Z_LPF_B0[14] | Z_LPF_B0[13] | Z_LPF_B0[12] | Z_LPF_B0[11] | Z_LPF_B0[10] | Z_LPF_B0[9] | Z_LPF_B0[8] | 0x00 | R/W |
| **0xAF** | Z LPF Coefficient B1 LSB | Z_LPF_B1[7] | Z_LPF_B1[6] | Z_LPF_B1[5] | Z_LPF_B1[4] | Z_LPF_B1[3] | Z_LPF_B1[2] | Z_LPF_B1[1] | Z_LPF_B1[0] | 0x00 | R/W |
| **0xB0** | Z LPF Coefficient B1 MSB | Z_LPF_B1[15] | Z_LPF_B1[14] | Z_LPF_B1[13] | Z_LPF_B1[12] | Z_LPF_B1[11] | Z_LPF_B1[10] | Z_LPF_B1[9] | Z_LPF_B1[8] | 0x00 | R/W |
| **0xB1** | Z LPF Coefficient A1 LSB | Z_LPF_A1[7] | Z_LPF_A1[6] | Z_LPF_A1[5] | Z_LPF_A1[4] | Z_LPF_A1[3] | Z_LPF_A1[2] | Z_LPF_A1[1] | Z_LPF_A1[0] | 0x00 | R/W |
| **0xB2** | Z LPF Coefficient A1 MSB | Z_LPF_A1[15] | Z_LPF_A1[14] | Z_LPF_A1[13] | Z_LPF_A1[12] | Z_LPF_A1[11] | Z_LPF_A1[10] | Z_LPF_A1[9] | Z_LPF_A1[8] | 0x00 | R/W |
| **0xB3** | Z LPF Coefficient A2 LSB | Z_LPF_A2[7] | Z_LPF_A2[6] | Z_LPF_A2[5] | Z_LPF_A2[4] | Z_LPF_A2[3] | Z_LPF_A2[2] | Z_LPF_A2[1] | Z_LPF_A2[0] | 0x00 | R/W |
| **0xB4** | Z LPF Coefficient A2 MSB | Z_LPF_A2[15] | Z_LPF_A2[14] | Z_LPF_A2[13] | Z_LPF_A2[12] | Z_LPF_A2[11] | Z_LPF_A2[10] | Z_LPF_A2[9] | Z_LPF_A2[8] | 0x00 | R/W |

| Bit | Name | Function | Description |
|---|---|---|---|
| **0xAD 7:0**<br>**0xAE 7:0** | Z LPF Coefficient B0/B2 LSB/MSB | 16-bit value for LPF coefficient B0 (unsigned) | This coefficient may be changed to match different ODR/sample rates and BW requirements. |
| **0xAF 7:0**<br>**0xB0 7:0** | Z LPF Coefficient B1 LSB/MSB | 16-bit value for LPF coefficient B1 (unsigned) | This coefficient may be changed to match different ODR/sample rates and BW requirements. |
| **0xB1 7:0**<br>**0xB2 7:0** | Z LPF Coefficient A1 LSB/MSB | 16-bit value for LPF coefficient A1 (unsigned) | This coefficient may be changed to match different ODR/sample rates and BW requirements. *This value is always considered a negative coefficient by the filter hardware.* |
| **0xB3 7:0**<br>**0xB4 7:0** | Z LPF Coefficient A2 LSB/MSB | 16-bit value for LPF coefficient A2 (unsigned) | This coefficient may be changed to match different ODR/sample rates and BW requirements. |

**Table 6-87: Registers 0xAD-0xB4 bit assignments**



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# 9 REVISION HISTORY

| Date | Revision | Description |
|---|---|---|
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